EXECUTIVE NEWSLETTER

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FUSION POWER ASSOCIATES

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SCIENCE MAGAZINE CREATES BIG FUSION FLAP

SCIENCE HYPE

Using the tried and true methods of tabloid journalism, Science magazine hyped a scientific paper by two University of Texas scientists creating a frenzy of media stories that a major international fusion project (the International Thermonuclear Experimental Reactor (ITER)), still in the design stage, would not meet its performance objectives. Fusion scientists from around the world were quick to point out the shortcomings of the predictions and the predictions of other, more extensively-benchmarked, models indicating that the objectives would likely be met. But by then the stories were on the wire services and the damage was done.

As often happens in circumstances of this sort the article itself, by science writer James Glanz in the December 6 issue, was more balanced than the headline that accompanied it: "Turbulence May Sink Titanic Reactor." Still the article might have gone largely unnoticed, except for the fact that Science chose to hype the article by issuing a press release the day before the issue came out, offering advance copies to the media. The press release was totally unbalanced, proclaiming at the top: "Multibillion-Dollar Fusion Reactor Won't Work, Say Scientists in 6 December Science News Report." Further, they say, in their best conspiratorial tone, "Science has learned that the theory's two creators -- William Dorland and Michael Kotschenreuther of the University of Texas at Austin -- have warned ITER scientists that, according to their calculations, ITER 'wouldn't work and by a substantial margin.'"

CNN was quick to send camera crews off to Texas, and to the Princeton Plasma Physics Laboratory where two other scientists had collaborated on some aspects of the theory. All day December 6, CNN Headline News ran a story that began: "You may not know an iota about the atom, but your wallet may be the nucleus of fusion research. Each year, American taxpayers funnel $55 million into a project to harness the power of the sun. But new research dims the prospect for its success, and for the return on your money." It then flips to a video clip of Dorland saying, "Our analysis indicates that this device (ITER) will not produce the amount of power desired, because the fuel will be too cold." Dorland later told Fusion Power Associates, "I agree that the CNN story was superficial and misleading. I learned a big lesson there!"

Business Week, which was just going to press when the story broke, quickly added its judgement in an article headed, "A Mighty Fusion Reactor -- Or a Mighty Fizzle?" They say, "But this grand vision (the world's first self-sustaining fusion reaction by 2010) may be going sour. The December 6, 1996, issue of Science magazine reports that a new theory of plasma physics shows that the mighty ITER reactor would prove to be nothing more than an expensive fizzle." USA Today ran a story headlined, "Researchers Say $10 Billion Fusion Project Flawed." They say, "A $10 billion international fusion energy project won't work, a new theory indicates, but a government official said the design can be changed if necessary." The New York Times headlined, "Cold Calculations Chill the Hot Pursuit of Cheap Fusion Power." An editor at the Washington Post said they would not run the story because the issue was primarily a disagreement among scientists and it would be too technical for most Post readers to understand.

The Science article (which can be accessed on the World Wide Web at http://www.sciencemag.org/science/scripts/display/full/274/5293/1600.html) quotes well-known fusion scientist and senior advisor to the ITER project Marshall

Rosenbluth as saying the theory is "a remarkable intellectual achievement." But Rosenbluth claims he was referring to recent advances generally in the theories of turbulence and not to the specific predictions of ITER performance from this model. Rosenbluth is composing his own letter to Science, as are many other fusion scientists.

ITER ADVISORS RESPOND

By happenstance, the ITER Technical Advisory Committee (TAC) was meeting in Japan when the story broke. The TAC, which provides overall technical review of the ITER design and recommends changes when appropriate, consists of senior fusion scientists from around the world and is chaired by Paul Rutherford, a highly respective theoretical physicist from the U.S. The TAC issued a statement December 7, which is reproduced below in its entirety.

"The members of the ITER Technical Advisory Committee (TAC), meeting in Japan for the purpose of reviewing the ITER Detailed Design Report, take note of the concerns expressed in the latest issue of Science Magazine in regard to projected performance in ITER. The following relevant statements are extracted from the report of the TAC meeting:

"In regard to the physics basis for ITER, the TAC notes that there is an international worldwide physics effort in support of ITER, encompassing seven Physics Expert Groups and involving many ITER-specific studies in the experimental and theoretical programs of the Parties. This effort was reflected in a large number of ITER-relevant papers presented at the recent IAEA Fusion Energy Conference. The new experimental results presented at the IAEA conference have, in general terms, confirmed and strengthened the physics basis for the ITER design. Remaining open issues are being resolved by focussed experimental effort in the tokamak programs of the Parties. The TAC also takes note of the encouraging worldwide progress in the development of physics-based transport models for tokamaks and endorses the ongoing effort by the JCT and the Physics Expert Groups to include such models in projections of plasma performance in ITER. The TAC's overall assessment of the physics basis for ITER is that the present design parameters have been well-chosen for meeting ITER's technical objectives.

"The development of new databases and dimensionally correct characterizations, implemented with care, provides at the present time the most validated way of projecting ITER performance. The Home Teams, Physics Expert Groups and the fusion community are to be congratulated for their combined efforts on ITER performance predictions. Significant progress has also been made in the development of turbulent transport models, taking into account flow shear and flux surface geometry. However, further evaluation and validation of these models against experiment is needed before they can be relied upon for quantitative ITER projections."

A statement has also been prepared by several members of the U.S. fusion community. Contact Dale Meade at PPPL to request a copy: dmeade@pppl.gov

PERSPECTIVE

Large engineered systems, like aircraft, chemical factories, nuclear power plants and fusion engineering test reactors, are designed using semi-empirical formulas. The systems are too complex to be designed from first principles of physics. Physical principles are used to guide the functional form of the design formulas, while empirical constants, benchmarked against experiment, are used to quantify the results. This is a tried and true technique for designing large, complex systems. In recent months, the DOE and its advisory committees have fostered the view that they had "restructured" the fusion program "with a change of focus from an energy technology development program to a fusion energy sciences program." They hinted that by doing so they would develop a predictive capability, based on scientific fundamentals, to replace the semi-empirical scaling laws now in use for the design of new, large experiments like ITER. In this new rhetorical culture, the announcement of a newly developed theory of turbulence, derived "directly from basic physics principles," seemed like an immediate validation of the new DOE policy. Science writer Glanz leapt for the bait. "For decades," he wrote, "physicists designing new tokamaks have been forced to extrapolate from experiments to estimate how fast this complicated turbulence will cause heat to leak across such (magnetic) fields. Instead (the Texas) work derives the rates directly from basic physics principles."

Nevertheless, when aircraft are designed outside the demonstrated design envelope they are first designated as "experimental." Similarly, the "E" in ITER stands for "Experimental." To the professional designer, this means that he/she is designing outside the currently-validated data

great advantage to European industry and laboratories." The panel said that Europe's excellent track record in operating the Joint European Torus (JET) in Culham gives it an advantage over proposals to site ITER in Japan or Canada.

The Board recommended that Europe's activities in inertial confinement fusion be maintained at about the present level of 2 % of the fusion budget. Inertial fusion advocates had hoped to increase the fraction to about 10%.

In preparation for ITER participation, the Board recommended that particular attention be paid to the "organization of system engineering and to the consequent optimization of industrial participation." They recommended that participation in ITER be complemented with other research, such as neutron irradiation of materials and other concepts such as stellarators. They urged that there be increased research on the safety, environmental and sociological impact of fusion as an energy source. "A successful fusion programme must lead to an energy source which is both economically and socially acceptable," the Board notes. The Board says that if ITER does not go ahead as an international venture, it is unlikely that Europe can afford to go it alone. In that case, Europe will have to rethink its fusion strategy, the Board says.

The recommendations of the Board must eventually be approved by the European Parliament and the Council of Ministers, as part of the 5-year budget setting process. More resistance to the fusion budget is expected this year than in past years. As in the U.S., activists for more research on renewable energy sources have lobbied against fusion, using the cost of ITER as one element of their argument.

FESAC PLANS ITER REVIEW

The DOE's Fusion Energy Sciences Advisory Committee (FESAC) will begin a review of the recently completed ITER Detail Design Report at a meeting beginning at noon January 21 and ending at noon January 24. Dr. Robert Aymar, director of the ITER Joint Central Team, and others associated with the ITER project, will present the design. The FESAC will also take public comment on ITER at the meeting. The meeting will take place at General Atomics in San Diego. Persons wishing to attend should contact Marion Stav (stav@gav.gat.com) before January 15. Persons wishing to sign up for public comment should contact Al Opdenaker (opdenaker@mailgw.er.doe.gov). The controversies described earlier should make this an interesting FESAC meeting.

JAPAN CLAIMS REACHING CONDITIONS EQUIVALENT TO FUSION BREAKEVEN

In JT-60U Experiment Report No. 39, dated November 11, 1996, scientists at the Japan Atomic Energy Research Institute state that "a high fusion performance satisfying the break-even plasma condition was achieved on October 31, 1996." The results, obtained in a deuterium-only plasma, were equivalent to an energy multiplication factor Q(DT), the value expected if a 50-50 mixture of deuterium and tritium had been used, of 1.05. Energy confinement time of 0.97 seconds, ion temperature of 16.5 keV, and electron density of 9.7×10^{19} m^{-3} were reported. The report states, "This achievement demonstrates the feasibility of bootstrap-current-driven steady-state tokamak fusion reactors whose primary operational scheme is the negative magnetic shear discharge. (See our September 1995 newsletter for a discussion of negative magnetic shear.) Information on JT-60U results can be found on their web page (http://www-jt60.naka.jaeri.go.jp)

THE CASE FOR FUSION?

In a recently published book, The Case for Mars (Free Press, 1996), space pioneer Robert Zubrin presents the reasons he believes that "Establishing the first human outpost on Mars would be the most historic act of our age." Regarding fusion, Zubrin states (p.246) "Fusion propulsion will ultimately make travel to Mars possible on a time-scale of weeks instead of months, travel to Jupiter and Saturn possible in months instead of years, and travel to other solar systems on time scales of decades instead of millennia." He says, "It may be that fusion spacecraft propulsion will evolve as an outgrowth of terrestrial-power, but the reverse is at least equally likely." He notes that "To a consumer, a kilowatt is a kilowatt, whether produced by thermonuclear fusion or burning coal. But a fusion-powered spacecraft offers totally new and dramatically superior possibilities over any lower technology." He concludes, "Currently the world's fusion research programs are proceeding at a snail's pace, devastated by budget cuts from shortsighted politicians who have neither the capacity nor the inclination to address future necessities. By forcing us to tackle the problems of fusion technology development, the growth of Martian civilization may well provide the basis for the survival of technology society. For further information, check out Zubrin's web site (http://www.magick.net/mars)

base, i.e., extrapolating from the current data base. The further out one ventures from current experience, the larger the uncertainty in performance. Designers typically put in a "safety factor" or "design margin" to account for such uncertainties.

When it was designed and constructed (1976), the Tokamak Fusion Test Reactor, now in its final year of operation at the Princeton Plasma Physics Laboratory, was a very large extrapolation from the data base of the time. It nevertheless achieved its performance objectives, producing two years ago 10 Megawatts of fusion power in pulses lasting a few seconds. The ITER plasma is about three times the size of the TFTR plasma and is designed to produce about 1000 Megawatts for 1000 seconds. Thus ITER is also a step beyond current experience.

ITER designers have been using several models, benchmarked against the current data base. Most of these models have been of the semi-empirical type. Recently, aided by advances in theory and computational capability, plasma scientists have begun to advance what are sometimes called theory-based models. Impressive progress has been made on such models and the model described in the Science article (usually referred to as the IFS-PPPL model) is one of several. It should be said that Dorland and Kotschenreuther are held in high regard in the fusion theory community and no one questions the quality of their work. However, their model, as all theory-based models, is most applicable to the center region of the plasma, while the overall performance of a given device, such as ITER, requires a complete treatment, all the way to the boundary. In order to calculate overall performance, a variety of assumptions must be made, so that the theory-based models themselves become semi-empirical. According to the minutes of the October 13-16, 1996 meeting of the ITER Expert Group on Confinement Databases and Modeling, over half a dozen models are being compared to existing data and "The Dorland-Kotschenreuther model performed no better than any of the other half dozen or so models being tested." Another theory-based model, that of Kinsey, Bateman and Kritz is characterized as showing "considerable less deviation from experimental results than the others." This model gives more optimistic predictions for ITER. The theory-based models have been much less extensively tested against the current data base than the semi-empirical models used to design ITER. Dorland indicated to Fusion Power Associates that he and his colleagues have proposed several tests of their model that could be performed on existing tokamaks and that they are actively engaged in dialogue with ITER's designers.

SANDIA UPS X-RAY RECORD

Using the recently reconfigured Particle Beam Fusion Accelerator, PBFA-Z, researchers at Sandia National Laboratory, Albuquerque, have increased their pulsed x-ray capability from 500 kJ, 85 terawatts achieved in the Saturn facility (See our June 1996 newsletter) to 1800 kJ, 160 terawatts. The results were achieved by driving 17 MA of current through a cylindrical array of 120 fine tungsten wires inside a small, thimble-sized gold can. (7 MA were used in the Saturn experiments.) The high current vaporizes the wires and drives an imploding z-pinch in Xenon filling gas, creating a high density, x-ray emitting plasma.

The x-rays are useful in simulating the effects of nuclear weapons and for verifying the predictions of weapon computer codes as part of the nation's Science-Based Stockpile Stewardship Program. Large bursts of pulsed x-rays are also important for driving symmetric implosions of small capsules of fusion fuel as part of the DOE's inertial confinement fusion program. For further information, contact Dr. Gerold Yonas, gyonas@sandia.gov

EUROPEAN FUSION REVIEW

The 1996 Fusion Evaluation Board, established by the European Commission (EC) and chaired by Sergio Barabaschi of the Ansaldo Company, Italy, has completed its report. The Board had a broad charter. Contrary to statements by the science ministers of France and Germany (See our August 1996 newsletter) stating that they would not recommend that their countries bid to host the International Thermonuclear Experimental Reactor (ITER), the Board recommended that Europe should put in a bid to provide a site for the ITER facility. If it is decided to site ITER elsewhere, the Board said, Europe should nonetheless "maintain a strong participation in ITER as the first priority of (its) fusion programme." The Board said that they were "impressed" by fusion progress since 1990 (the time of the last review) and "in particular through the integrated design work performed for ITER." They said that ITER had provided a "focusing role" for European fusion work and recommended that role be continued. "ITER should be built in Europe," the Board said, "as this would maintain Europe's position as world leader in fusion and would be of

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U.S. ITER DESIGN REVIEW BEGINS
DOE SELECTS LLNL AS NIF SITE

U.S. ITER REVIEW STARTS

A major review of the design of the International Thermonuclear Experimental Reactor (ITER) was initiated January 21, as scheduled, by the DOE Fusion Energy Sciences Advisory Committee (FESAC), following the acceptance of the Detailed Design Report (DDR) by the ITER Council (IC) at its December 17-18 meeting in Tokyo. Although there have been many design changes, the overall size, cost, and objectives of ITER remain about the same as those of the Interim Design Report issued a year ago. The total estimated cost of ITER construction is approximately $8.8 billion ($1995).

At the January 21-24 FESAC meeting at General Atomics in San Diego, presentations of the ITER DDR were given by Dr. Robert Aymar, Director of the ITER Joint Central Team, and by others associated with the ITER project. Public comment was then received by the FESAC. Following that, there were a series of meetings by subpanels which will carry out the technical review.

The FESAC is responding to a charge from DOE Director of Energy Research Martha Krebs, dated September 23, 1996, "to provide its (FESAC's) view of the adequacy of the DDR as part of the basis for a United States decision to enter negotiations (of the terms and conditions for an agreement for the construction, operations, exploitation and decommissioning of ITER)." Those negotiations are scheduled to begin in July 1997, one year before the end of the current Engineering Design Activities. Krebs asked the FESAC to report by May 1, 1997, but FESAC chairman John Sheffield, of Oak Ridge National Laboratory, has indicated his desire to complete the task earlier.

ITER COUNCIL ACCEPTS DESIGN REPORT

At its December 17-18 meeting, the ITER Council (IC), chaired by Academician E. P. Velikhov (Russian Federation) "accepted for consideration by the Parties, the Detailed Design Report, Cost Review and Safety Analysis (DDR)." They "noted that the new experimental results have, in general terms, confirmed and strengthened the physics basis for the ITER design." They accepted a report from the ITER Technical Advisory Committee (TAC), "noting the TAC recommendation that the Detailed Design Report offers a sound basis for proceeding to the Final Design . . . ." The IC "noted with appreciation that essentially no change has occurred in the overall cost estimate presented in the Interim Design and Cost Review in 1995." They invited the Parties to present, at the next IC meeting scheduled for 23-24 July in Europe, "their views on the DDR and any related technical comments arising from their domestic reviews," and "encouraged the Parties to notify the Director informally at the earliest opportunity of technical points arising from their domestic reviews that might affect the preparation of the Final Design Report (scheduled to be completed by December 1997)." The Council "invited the Parties to consider taking actions needed to permit smooth transition into construction activities." In a Press Guideline issued after the meeting they also stated that "The Council was informed that two meetings of non-committal, pre-Negotiation, exploratory discussions, called Explorations, were held at the end of last July and in December just before the IC Meeting. Subsequent Negotiations would hopefully allow a start of construction without delay after the present EDA, which are planned to be concluded in July, 1998." James Decker and Anne Davies, DOE, represent the U.S. on the Council.

LIVERMORE IS NIF SITE

The U. S. Department of Energy, which has long indicated that the Lawrence Livermore National Laboratory is the "preferred" site for the National Ignition Facility (NIF), officially designated Livermore as the site on December 19. The action follows the completion and issuance of the multi-volume Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management (DOE/EIS-0236, September 1996. Call 1-800-776-2765 to request a copy). Several anti-nuclear groups, led by the National Resources Defense Council, have threatened to go to court to prevent DOE from implementing various aspects of the so-called "Stockpile Stewardship" plan, by claiming that the analysis was inadequate or flawed. However, at press time, no court action had been filed. As the largest of several new facilities planned as part of the Stockpile Stewardship program, NIF has become a target. An article in the News section of the December 1996 issue of Scientific American, for example, quotes several NIF opponents. Tom Zamora Collina, of the Institute for Science and International Security (Washington, DC), for example, states of NIF, "It's not evil. It's just a waste of money." Nevertheless, NIF currently enjoys a high priority within the DOE, the Administration, and Congress. A committee of the National Academy of Sciences, which has been reviewing NIF in the context of the Stockpile Stewardship program, is expected to endorse the NIF. Their report, which is now in draft, is due out in March. NIF is expected to ignite a small capsule of fusion fuel, after compressing and heating it with the energy from a large laser beam, thereby releasing about 10 times more energy from fusion than is in the laser beam. The facility is projected for initial operation in late 2002.

FUSION IN CONGRESS

During the past two years of Congressional budget cutting, Inertial Confinement Fusion, as part of DOE's Defense Programs, has been faring well in Congress, while the Office of Fusion Energy Sciences, part of DOE's civilian research programs has been brutalized. The key subcommittee charged with financial action is the Subcommittee on Energy and Water, House Committee on Appropriations. The previous chairman of that subcommittee, John Myers (R-IN) did not run for reelection. The new chairman is Joseph M. McDade (R-PA). "Joe" has been in the House since 1963. He is 65 years old and makes his home in Scranton, PA. He is an attorney by profession, having received his law degree from the University of Pennsylvania in 1956, after receiving his BA degree from the University of Notre Dame in 1953. He was previously on the full Appropriations Committee but not on the Energy and Water Subcommittee. He can reached at 2107 RHOB, Washington, DC 20515-3810; (202)225-3731; fax -9594.

Other members of the Energy and Water Subcommittee are Harold Rogers (R-KY), Joe Knollenberg (R-MI), Rodney Frelinghuysen (R-NJ), Mike Parker (R-MI), Sonny Callahan (R-AL), Jay Dickey (R-AK), Vic Fazio (D-CA), Peter Visclosky (D-IN), Chet Edwards (D-TX), and Ed Pastor (D-AZ). Only Rogers, Knollenberg, Frelinghuysen, and Fazio were on the Subcommittee last year.

In other key posts: James Sensenbrenner (R-WI) will chair the House Science Committee with Ken Calvert (R-CA) expected to chair the Subcommittee on Energy and Environment, replacing fusion nemesis Dana Rohrabacher. Frank Murkowski (R-AK) will continue to chair the Senate Energy Committee, with Pete Domenici (R-NM) continuing to chair the Subcommittee on Energy Research and Development. Ted Stevens (R-AK) will chair the Senate Appropriations Committee, with Pete Domenici (R-NM) continuing to chair the Subcommittee on Energy and Water Development.

EUROPEAN FUSION EVALUATION REPORT

The 1996 Fusion Evaluation Board, established by the European Commission (EC) and chaired by Sergio Barabaschi of the Ansaldo Company, Italy, has completed its report. The Board had a broad charter and was commissioned as part of the preparation of the next EC 5-year budget planning cycle.

The Board stated, "Fusion is one of the few energy sources which might make a significant contribution to satisfy the growing need for electricity from the middle of the 21st century onward. Taking into account intrinsic safety aspects, potential environmental advantages and the wide availability of fuel, it is important for Europe to have this option open. // The Board confirms the validity of the long-term R&D strategy recommended by previous panels and endorsed in the 1994 Council Decision: on the path to the Demonstration reactor (DEMO), only one large device is needed, i.e., a tokamak experimental reactor (ITER)."

The Board said, "Fusion R&D has now reached a stage where it is scientifically and technically possible to proceed

with the construction of the first experimental reactor, and this is the only realistic way forward. Starting construction of ITER is therefore recommended as the first priority of the Community Fusion Programme under the Fifth Framework Programme."

The Board stated that it "is supportive of ITER being hosted in Europe." (Previously the Science Ministers of France and Germany had said they would not recommend proposals be made to site ITER in their countries; subsequently Italy indicated that they might be receptive to making a bid. See our August 1996 newsletter.) "ITER should be built in Europe," the Board said, "as this would maintain Europe's position as world leader in fusion and would be of great advantage to European industry and laboratories." The Board stated, "The hosting of this facility would put Europe in a position to gain experience, framed in our own context, in solving the many complex problems that lie ahead: licensing procedures in a European regulatory framework, organisation of construction and logistics of a fusion reactor, gaining public acceptance in Europe, etc." If ITER is built elsewhere, the Board said, Europe "should in any case remain a sufficiently strong partner to keep a leverage on the project and to develop an independent capability to move later towards the prototype commercial reactor." They said they were "impressed" with progress since 1990 (the time of the last review) and "in particular through the integrated design work performed for ITER." They said that ITER had provided a "focusing role" for European fusion work and recommended that such a role continue. In preparation for ITER participation, the Board recommended that particular attention be paid to the "organisation of system engineering and to the consequent optimisation of industrial participation."

They recommended that participation in ITER be complemented with other research, particularly mentioning neutron irradiation of materials and research on stellarators. They urged that there be increased research on the safety, environmental and sociological impact of fusion as an energy source. "A successful fusion programme must lead to an energy source which is both economically and socially acceptable," the Board noted.

The Board recommended that "The watching brief on Inertial Confinement Fusion be maintained (at about the present level of 1-2% of the fusion budget). Inertial fusion advocates had hoped to increase the fraction to about 10%. The Board did recommend increased "coordination of the civilian national (Inertial Confinement Fusion) efforts in Europe."

The recommendations of the Board must eventually be approved by the European Parliament and the Council of Ministers, as part of the 5-year budget approval process. More resistance to the fusion budget is expected this year than in past years. As in the U.S., activists for other programs have lobbied against fusion.

REPORTS OF INTEREST

The following recently released reports may be of interest to our readers:

"Economic Impacts on the United States of Siting Decisions for the International Thermonuclear Experimental Reactor: Executive Summary," (ANL/DIS-2-ES, August 1996). Contact Jim Peerenboom: jpeerenboom@anl.gov

"Complexity Versus Availability for Fusion: The Potential Advantages of Inertial Fusion Energy," (UCRL-ID-125857, September 5, 1996). Contact John Perkins: perkins3@llnl.gov

"Z Pinches as Intense X-Ray Sources for High Energy Density Physics Applications." Contact Keith Matzen at Sandia National Laboratories: mkmatzen@snl.gov

"A Tokamak Tritium Production Reactor," (GTFR-132, October, 1996). Contact Bill Stacey at Georgia Tech: weston.stacey@me.gatech.edu

"Annual Report of Naka Fusion Research Establishment, JAERI," (April 1, 1995 to March 31, 1996). Contact Michiya Shimada: shimada@expert1.naka.jaeri.go.jp

"Fusion Programme Evaluation 1996: Findings and Recommendations, (Report of the 1996 European Fusion Programme Evaluation, S. Barabaschi, Chairman, November, 1996, EC Report XII-373/96, 40 pages). Contact Hardo Bruhns: hardo.bruhns@dg12.cec.be or Steve Dean at Fusion Power Associates: 72570.707@compuserve.com

"Report From the Planning Workshop For the Fusion Energy Sciences Program," (October 22-24, 1996). Contact Stewart Prager: prager@juno.physics.wisc.edu

DOE, NSF ANNOUNCE PLASMA INITIATIVE

The National Science Foundation and the Department of Energy Office of Fusion Energy Sciences have announced a joint initiative called the "Partnership in Basic Plasma Science and Engineering." The expressed purpose of the initiative is to enhance plasma research and education in this broad, multidisciplinary field by coordinating efforts and combining resources from the two agencies." The announcement (from NSF) states, "The focus of this initiative is to address fundamental issues in plasma science and engineering which can have impact in other areas or disciplines in which improved basic understanding of the plasma training is integrated within the research programs. Proposals related to fusion studies are not eligible." The announcement states that "Award sizes are anticipated to range from $25,000 to $200,000 per year with duration of up to three years, depending on the nature of the research activity. Subject to the availability of funds, the two agencies have designated approximately $13 million for a total of 25-30 awards in this competition." Abstracts are due by February 28; proposals by March 21. Funding will only be provided to universities or non-profit organizations, though teaming with laboratories or industry is allowed. For further information, contact Ron McKnight at DOE: ronald.mcknight@mailgw.er.doe.gov or Barry Schneider at NSF: bschneid@nsf.gov

WEB NOTES

Recipients of this Executive Newsletter may find the following web sites of interest:

Since last July, Fusion Power Associates had been issuing, to its members and affiliates, a series of email news notes called "Fusion Program Notes." These are archived at http://aries.ucsd.edu/fpa/

A list of Fusion Power Associates institutional members and affiliates, and statement of our general purposes, can be found on the Fusion Power Associates Home Page: http://wwwofe.er.doe.gov/More_HTML/FusionPowerAssociates.html/

Information on heavy ion fusion can be found at http://fusion.lbl.gov/US_HIF.html/

PEÑA NOMINATED FOR ENERGY SECRETARY

Confirmation hearings were scheduled for January 30 for Federico Peña, President Clinton's nominee to replace Hazel O'Leary as Secretary of Energy. Peña was Secretary of Transportation during President Clinton's first term. Prior to that, he was mayor of Denver. According to the Washington Post, he was known at the Department of Transportation as someone who was uncomfortable with the slow pace of bureaucracy and who liked to take an activist role in the affairs of the Department. He was also known as someone who surrounded himself with a small circle of insiders and often ignored professional staff members of his Department. Because of his unfamiliarity with the programs of the Department of Energy, several Senators have said that his confirmation hearings would not be routine. Some trade groups have also said they would oppose his nomination. His views on fusion are unknown.

MEETINGS

March 10-14 Current Trends in International Fusion Research. Washington, DC. Contact E. Panarella: alft@on.infoshare.ca

April 23-26 Joint U.S. - European Transport Task Force Workshop. Madison, WI. Contact Dorothy Tate: fax (423)576-7926.

April 28-30 1997 International Sherwood Fusion Theory Conference. Madison, WI. Contact Ms. Pat Gaitan: gaitan@admin.uwex.edu

May 26-28 Sixth All-Russian Conference on Engineering Problems of Thermonuclear Reactors. St. Petersburg, Russia. Contact: EPTR@niiefa.spb.su

QUOTABLE

"Because of the ever receding target for the first commercial demonstration of nuclear fusion energy, few tears are being shed outside the plasma physics community for the moribund U.S. program. Still, it bears noting that the United States has now ceded leadership in two major fields using the most advanced superconducting magnet technology -- in particle physics to Europe's CERN and now, in fusion, to East Asia."

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INDUSTRY IMPORTANT FOR ITER SUCCESS
PRESIDENT CLINTON ENDORSES NIF

ITER AND INDUSTRY

At the January 21-22 meeting of the Department of Energy's Fusion Energy Sciences Advisory Committee (FESAC) in San Diego, Fusion Power Associates president Steve Dean and ITER Industry Council Chairman Bill Ellis stressed that industrial involvement in the ITER project was absolutely critical to ITER's success. (Ellis is also chairman of Fusion Power Associates' Board of Directors and Vice President and Chief Scientist of Raytheon Engineers and Constructors.) Dean noted that "ITER is much more than a science experiment." It is "a large, multi-billion-dollar, complex engineering device on the scale, or even beyond that, of the most advanced nuclear power plants. As such it requires the experience of industry to ensure a manufacturable, maintainable, reliable design; and tight cost and schedule management during its construction." Ellis presented a statement on behalf of the ITER Industry Council (which met January 20). He said that the "U.S. ITER Industry Council believes that construction of ITER is technologically feasible. The job is complex and challenging, but it can be done." He noted ITER will produce 1000 to 2000 Megawatts of power and this raises "issues of reliability, availability, maintainability and inspectability." Because of these engineering features, he said, "ITER's success requires industrial participation." ITER Project Director Robert Aymar told the FESAC that the purpose of ITER was the "demonstration of the technologies essential for a power reactor and the confirmation of the physics basis." He said that ITER will be judged a success "if it allows the Parties to proceed to construction of a demonstration power plant."

POTENTIAL U.S. SITE FOR ITER

The Department of Energy has said that it will not propose a U.S. candidate site for ITER, due to limited financial resources but, instead, will plan for limited participation in an international joint venture at a foreign site. Not everyone is listening to the DOE, however. Charles DeVaney, Executive Vice President of Augusta Tomorrow, Inc., and also representing the Aiken, South Carolina Chamber of Commerce and the Greater Augusta Chamber of Commerce, told the FESAC meeting "I am here to promote fusion research in this country and, in particular, the International Thermonuclear Experimental Reactor (ITER)Project." He said "The United States should and must keep its options open for ITER siting. This costs us nothing. While it may be assumed that whichever of the four ITER partners puts up the most money will get the machine, this is not necessarily the case. All of us understand the need to balance our national budget. While our government may not be willing or able to put up a sizable amount of funding for the ITER siting, we should be a willing participant in the upcoming site negotiations. Certainly, the United States already has one of the best sites in the world for the ITER project and that is the Savannah River Site." He said, "All of us know that any nation who hosts the ITER machine will reap large economic, employment and scientific and technology benefits. That is why ITER should be located in this country and hopefully at the Savannah River Site." He remarked, "Certainly, this nation has always been willing to invest in its future. We have never turned projects over to others and sat on the sidelines. That simply is not America. In his inaugural address, President Clinton called upon our nation to invest in the future and to be prepared to lead in the 21st century. I would hope that the Department of Energy, the administration, and the Congress would reverse its position and participate actively in the ITER siting negotiations." Copies of DeVaney's remarks can be obtained from Fusion Power Associates. He can be reached at fax (706)722-9102; email: cdevaney@csranet.com

CLINTON BUDGET: FULL NIF FUNDING

In his FY 1998 Budget request, recently submitted to Congress, President Clinton asks for full authorization to complete construction of the National Ignition Facility (NIF). The $1.2 billion laser facility, to be located at the Lawrence Livermore National Laboratory, will begin partial operation in 2001 and full operation in late 2003. In a departure from past DOE practice of requesting partial funding year-by-year to continue construction projects, this year Clinton asks Congress to fully authorize the remaining $876 million to complete the NIF, with $229.1 million of that to be spent in FY 1998. In the past, failure of Congress to provide the necessary funding each year for construction projects has resulted in schedule slippages and cost increases for many projects. Overall, Clinton asks for $414.8 million for the Inertial Confinement Fusion program (including the $229.1 million for NIF construction), compared to the FY 1997 level of $336.46 million. The major recipients of these funds (with much of the money for NIF flowing through to industry) are Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Sandia National Laboratories, University of Rochester, General Atomics, and U.S. Naval Research Laboratory.

FUSION ENERGY PROGRAM IS LEVEL

In his FY 1998 budget request, President Clinton asks Congress to provide $225 million for the DOE Office of Fusion Energy Sciences (OFES), compared to $225.1 million in FY 1997. Although the total budget request is essentially level, the planned shutdown of the Tokamak Fusion Test Reactor (TFTR) at Princeton, "frees up" $24.836 million (according to the budget document), which DOE proposes to redistribute to the following programs: increase for National Spherical Torus Experiment at Princeton ($7.6 million); Princeton scientists working abroad ($1.965 million); increase DIII-D at General Atomics ($7.464 million); increase Alcator C-MOD at MIT ($2.464 million); increase small scale plasma experiments (0.233 million).

The OFES continues to hold down spending on the civilian aspects of inertial confinement fusion, providing only $6.9 million, compared to this year's $7.0 million and the FY 1996 level of $7.8 million. DOE advisory committees have indicated that a level of $10-15 million is required to allow the civilian inertial fusion energy program to capitalize on the projected success of the National Ignition Facility shortly after the turn of the century.

The OFES asks for $54.5 million for participation in ITER, essentially the same as in FY 1997 and FY 1996. The OFES says, in its budget document, "The planning assumption for U.S. involvement in any future ITER construction was changed from significantly increased participation to participation at the current level."

Elsewhere in the request for DOE, which is essentially flat at $16.6 billion, increases are sought for programs in Energy Efficiency and Renewable Energy (27%), civilian Nuclear Energy (36.2%), and defense Nuclear Energy (18.2%). The overall budget for the Office of Energy Research (which funds High Energy Physics, Computation, Fusion, and Basic Energy Sciences) is $2.5 billion, up 2.9% from FY 1997.

CLINTON LAUNCHES ENERGY STUDY

In response to a December 16, 1996 letter from his Committee of Advisors on Science and Technology (PCAST), President Clinton issued a letter, dated January 16, 1997, instructing his science advisor, Jack Gibbons, "to review the current national energy R&D portfolio, and make recommendations to me by October 1, 1997 on how to ensure that the United States has a program that addresses its energy and environmental needs for the next century." Clinton says, "The analysis should be done in a global context, and the review should address both near- and long-term national needs including renewable and advanced fission and fusion energy supply options, and energy end-use efficiency." In their December 16 letter, the PCAST recommended to the President a "restoration of fusion R&D funding to the levels recommended by PCAST last year." (See our July 1995 newsletter.) Copies of both letters are available from Fusion Power Associates or on a new national fusion web site at http://www.fusionscience.org/ The letters are under the "policy" heading.

NEW FUSION GROUP MEETS SEN. BOXER

Representatives of a new, informal, group of fusion researchers calling themselves SAFER (Scientists Advocating Fusion Energy Research) met with California Senator Barbara Boxer at a "Town Meeting" in San Diego on February 8. The SAFER reps were Rick Moyer and Lisa Blush of the University of California at San Diego. Lisa reports that Rick was the first person to speak at the meeting and that his comments "were well received by Senator Boxer." Lisa says that Senator Boxer "reiterated her past support (for fusion) and indicated her continued commitment to science R&D." Persons wishing more information on how to participate in the activities of SAFER should contact Andrew Post Zwicker by email: azwicker@pppl.gov

DAVIES RECEIVES GOLD MEDAL

On January 15, 1997, Secretary of Energy Hazel O'Leary presented The Secretary's Award to Dr. N. Anne Davies, Associate Director for Fusion Energy Sciences. The Secretary's Award is the highest incentive award given by the DOE for outstanding leadership ability.

The citation for the Award states "Your talents were honored in advancing the frontiers of science--but you have demonstrated the rare ability to meld scientific and organizational leadership skills. The results are the creative managerial and scientific innovation of your team. Your support of Quality and continuous improvement have resulted in a new and effective structure for the Nation's fusion science capabilities and advanced the needs of the American taxpayers, our number one customer." Congratulations Anne!

NEWS FROM MIT

Effective January 1, the MIT Plasma Fusion Center changed its name to the MIT Plasma Science and Fusion Center (PSFC). Although current email addresses will remain valid indefinitely, the preferred email address after March 1 will be (username)@psfc.mit.edu/ Center Director Miklos Porkolab also announced the appointment of Professor Jeffrey Friedberg as Associate Director and Dr. Richard Temkin as Assistant Director. These appointments fill vacancies left by the recent retirements of Associate Director Bruce Montgomery and the stepping down of Acting Deputy Director Dieter Sigmar and Assistant Director Dan Cohn. The MIT PSFC is an Institutional Affiliate of Fusion Power Associates.

WEB SITES OF NOTE

Readers of these newsletters may find the following web sites of interest:

A new national fusion web site is in the process of development at http://www.fusionscience.org

A view of the Alcator C-MOD cell, updated every few seconds, is at http://lost.pfc.mit.edu/cmod/live.html

MIT Alcator C-MOD quarterly progress reports are posted at http://cmod2.pfc.mit.edu/cmod/quarterly-reports/quarterly-reports.html

The "Interactive Plasma Physics Experience" is a student-oriented page on energy, fusion, and plasma physics. It also contains information on SAFER. It is at http://ippex.pppl.gov/ippex

ERRATA

In our February newsletter, we made a mistake in Sandia researcher Keith Matzen's email address. The correct address for information on recent exciting results on the pulsed power facility PBFA-Z is: mkmatze@sandia.gov

MEETINGS

Near-term meetings of interest, in addition to the meetings listed in last month's newsletter, include:

April 6-11 Fourth International Symposium on Fusion Nuclear Technology. Tokyo, Japan. Contact: isfnt@hooker.gen.u-tokyo.ac.jp

April 13-18 Thirteenth International Conference on Laser Interactions and Related Plasma Phenomena. Monterey, CA. Contact:lirpp97@uiuc.edu

April 18-21 Joint Meeting of the American Physical Society, American Association of Physics Teachers, and the APS Division of Atomic, Molecular and Optical Physics. Washington, DC. Contact APS Meetings Department (301)209-3286 or check web page at http://www.aps.org

IN MEMORIAM: PAUL TSONGAS

Paul Tsongas, former Democratic Senator from Massachusetts, died January 18 at age 55 from pneumonia associated with complications from bone cancer. He was co-sponsor of the Magnetic Fusion Energy Engineering Act of 1980 and was instrumental, along with former Congressman Mike McCormack, in securing near unanimous passage of the Act. The Act, which mandated a $20 billion, 20 year, program to demonstrate fusion power by the year 2000, was signed into law by President Carter on October 7, 1980, but was ignored by President Reagan and subsequent administrations. Although Congress never provided the funds or facilities called for in the Act, various members of Congress periodically complained that the 20 year schedule for producing fusion power did not seem to be getting any closer. Tsongas was a recipient of Fusion Power Associates first Leadership Award in 1980. Seemingly cured of cancer, he ran for the Democratic presidential nomination in 1992. We join his many friends in mourning the passing of this national statesman and visionary.

PARTIAL LIST OF U.S. INDUSTRIES INVOLVED IN FUSION R&D

Advanced Energy Resources, Inc.
Germantown, MD
ADVOCET
San Francisco, CA
Applied Fusion Technologies
Fort Collins, CO
ARC Applications
York, PA
Arrowhead Tool, Inc.
Fenton, MO
Atlas Foundry & Machine
Tacoma, WA
Babcock & Wilcox, Inc.
Lynchburg, VA
Bechtel Group, Inc.
San Francisco, CA
BIW Cable Systems, Inc.
North Dighton, MA
Boeing Rocketdyne
Canoga Park, CA
Brush Wellman, Inc.
Cleveland, OH
Burns & Roe, Inc.
Oradell, NJ
Calabazas Creek Research
Saratoga, CA
Ceramaseal
New Lebanon, NY
Chicago Bridge & Iron
Plainfield, IL
Coleman Research
Springfield, VA
Continental Electronics
Dallas, TX
CPI, Inc.
Palo Alto, CA
Composite Technology, Inc.
Boulder, CO
Creare, Inc.
Hanover, NH
Cryogenic Materials, Inc.
Boulder, CO
Dielectric Communications
Raymond, ME
EBTEC Corporation
Agawam, MA
E.H. Wachs Company
Wheeling, IL
Eimac Corp.
San Carlos, CA
Everson Electric Company
Bethlehem, PA
F.N. Anderson & Associates, Inc.
Lynchburg, VA
Failure Analysis
Cambridge, MA
Fluor Daniel
Irvine, CA
Fusion Physics & Technology
Torrance, CA
General Atomics
San Diego, CA
Industrial Materials Technology
Andover, MA
InterScience, Inc.
Troy, NY
IGC Advanced Superconductors
Waterbury CN
INCO Alloys International, Inc.
Huntington, WV
Karta Technology, Inc.
San Antonio, TX
Kemco
Fenton, MO
Krall Associates
Del Mar, CA
Litton Industries
San Carlos, CA
Lockheed Martin
San Diego, CA
Lodestar
Boulder, CO
Martinez & Turek
Rialto, CA
McDonnell Douglas
St. Louis, MO
Mueller Machining
St. Louis, MO
Nooter Corporation
St. Louis, MO
Northrop Grumman Corp.
Bethpage, NY
Northwest Technical Industries
Sequim, WA
OMG AMERICAS, Inc.
Research Triangle Park, NC
Omniview, Inc.
Knoxville, TN
Oxford Instruments, Inc.
Carteret, NJ
PaR Systems, Inc.
Placentia, CA
Paulo Products
St. Louis, MO
Pitt DesMoines, Inc.
Pittsburgh, PA
Plasma Processes, Inc.
Huntsville, AL
Precision Components Corporation
York, PA
Quaker Alloy
Myerstown, PA
Quantum Manufacturing, Inc.
Albuquerque, NM
Ralph M. Parsons Company
Pasadena, CA
Raytheon Engineers & Constructors
New York, NY
REMOTEC
Oak Ridge, TN
SAIC
San Diego, CA
Schwarzkopf Technologies Corp.
Franklin, MA
Sciaky, Inc.
Chicago, IL
Stone & Webster Engineering Corp.
Boston, MA
Supercon, Inc.
Shrewsbury, MA
Surmet Corporation
Burlington, MA
Teledyne Wah-Chang
Albany, OR
Thermacore, Inc.
Lancaster, PA
TRW, Inc.
Redondo Beach, CA
TSI Research
Solana Beach, CA
Variation Systems Analysis
Clair Shores, MI
W.J. Schafer Associates, Inc.
Livermore, CA
Wall Colmonoy Corp.
Dayton, OH
Westinghouse Corp.
Pittsburgh, PA
Westmoreland Test Labs
Youngstown, PA

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EXECUTIVE NEWSLETTER

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DOE APPROVES NIF CONSTRUCTION
PEÑA CONFIRMED AS ENERGY SECRETARY

PEÑA CONFIRMED

Federico F. Peña was sworn in as Secretary of Energy on March 12. President Clinton said that, as Transportation Secretary, Peña "built consensus among communities, business and government and streamlined operations to reap benefits for all taxpayers." He said, "With this record, I am confident that Secretary Peña has the skill, experience and dedication to lead the Energy Department to meet its central challenges -- to broaden America's energy resources, to promote a safer, more secure world and to help to create a brighter economic future for all Americans." Peña, a former mayor of Denver, Colorado, served as Transportation Secretary in Clinton's first term. Peña said, "The brilliant scientists and engineers, the unparalleled facilities of the national laboratories, and the top notch work DOE produces will continue to support our country's long-term economic, energy, environmental and national security interests." He was born in Laredo, Texas, in 1947 and holds bachelor's and law degrees from the University of Texas.

In an address to DOE employees, March 13, Peña said "I believe in products, not paper; production, not process; action, not reaction." Peña called DOE "an organization that is grounded in science and technology, with missions as important as any in the Federal government." He said, "I believe that those who are closest to a problem, those who work at it every day, usually have the best ideas on how to find solutions." He said his priorities were: "First, we will develop a realistic strategy for strengthening our nation's energy security. . . . Second, we must maintain the capacity and resources to assure the safety and reliability of our nation's nuclear deterrent. . . . Third, we must aggressively continue our cleanup of the environmental legacy of the Cold War . . . . Fourth, we must maintain our country's leadership in science and technology."

Regarding the first priority above, Peña said, "Recent history has demonstrated how vulnerable we are to a disruption in the flow of imported oil or volatility in its price. And the trajectory of increased consumption and imports is worsening. In addition, our current use of energy is not environmentally sustainable. I said before the United States Senate and I say to you: This is unacceptable."

Peña announced several key staff positions, including Elgie Holstein as chief of staff; Elizabeth Montoya as deputy chief of staff; Brooke Anderson as public affairs director; and Tom Vellenga, John Angell, Dan Reicher, and Kyle Simpson as senior policy advisors.

DOE APPROVES NIF CONSTRUCTION

The Department of Energy approved "start of construction," March 11, for the National Ignition Facility (NIF), a $1.2 billion laser fusion facility at the Lawrence Livermore National Laboratory (LLNL). DOE said, in a press release, that they expected groundbreaking "within the next few weeks." In announcing the decision, Charles B. Curtis, then Acting Secretary of Energy, said the facility "will help the United States meet the conditions of the Comprehensive Test Ban Treaty and reduce the global nuclear danger. The country will also benefit from cutting edge science in astrophysics and fusion energy."

The 192 beams of the 2 Megajoule laser will be focused on a small capsule containing deuterium-tritium fuel, heating and compressing the fuel to fusion temperatures and densities. More than 20 Megajoules of fusion energy is expected to be produced. The facility is expected to begin partial operation in 2001 and full operation in late 2003.

A group of "arms control" organizations opposed to weapons

research, have banded together under the leadership of the National Resources Defense Council (NRDC), to oppose NIF construction. As the largest single project in the DOE's "Stockpile Stewardship" program, NIF has become a target for those groups trying to downsize the U.S. nuclear weapons labs. The NRDC recently went to court claiming the National Academy of Sciences (NAS) National Research Council's Committee for the Review of the Inertial Confinement Fusion (ICF) Program, sponsored by DOE, had failed to follow federal law by meeting in private. NRDC put out a press release March 11 saying "The Academy convened what is surely one of, if not the most, biased, unbalanced, conflict-ridden committees in the annals of the National Academy of Sciences." In a preliminary ruling in early March, a U.S. District Court judge said "The Department of Energy is enjoined from providing or obligating any funding, monies or other forms of support to the ICF Committee or the to NAS for the purpose of supporting the ICF Committee . . . or utilizing, relying on or in any way incorporating into its decisionmaking process the ICF Committee report or any other work product of the ICF Committee." As part of its strategy to derail NIF, NRDC and its cohorts plan to also file a lawsuit claiming that DOE's environmental impact statement for NIF was inadequate.

Some recent popular articles on NIF: Science News (October 19, 1996, p. 254-255); Laser Focus World (November, 1996, p. 107-114); Popular Mechanics (February, 1997, p. 19), The Sciences (New York Academy of Sciences, September/October, 1996, p. 20-25). Reprints of the latter article, entitled "The Fire Next Time: Will the National Ignition Facility finally take the critical step toward controlled fusion energy?" (by William J. Hogan, Roger O. Bangerter, and Charles P. Verdon) are available from FPA.

DOE PLANS ACADEMY ITER REVIEW

DOE Director of Energy Research Dr. Martha Krebs has written a letter, dated March 17, to National Academy of Sciences president Bruce Alberts requesting "a National Research Council assessment of the scientific merit of the International Thermonuclear Experimental Reactor (ITER) program." Krebs asks that the assessment "address the following questions: (1) Is ITER likely to achieve its scientific objectives? (2) What new scientific research would ITER make possible? (3) What would be the value of ITER experimental results relative to the U.S. fusion energy sciences program objectives? (4) How would achieving ITER's scientific objectives contribute more generally to the advancement of U.S. science?" Krebs says that the "assessment will be an important input to the Department and Congress during the preparation of and deliberation on the FY99 fusion budget request" and she asks "to have the assessment by December 1, 1997."

ITER GAME PLAN CHANGING

The official future game plan for the International Thermonuclear Experimental Reactor (ITER) calls for a smooth transition from the current, so-called, Engineering Design Activities (EDA) phase, scheduled to end July 1998, to the Construction Phase. In her March 17 letter to National Academy of Sciences president Bruce Alberts, DOE Director of Energy Research Martha Krebs says "the U.S. expectation has been to join negotiations on a construction and operation agreement consistent with U.S. fusion program budget limitations." She says the Parties "intend to decide in early 1998 whether to begin such negotiations, probably including a two step construction approach consistent with proposals by the ITER Director." ITER Director Robert Aymar has suggested a "Post-EDA" or "Pre-construction Engineering" phase beginning July 1998 and lasting until mid- to late- 2000, at which time construction would begin in earnest. During this phase ITER engineering design and R&D required for the long lead procurements would be completed.

At the December 17-18 ITER Council meeting in Tokyo, Aymar asked the Council "to propose to the Parties at this time to take appropriate actions, inter alia, to permit smooth continuation of activities foreseen for the phase leading to construction." In the minutes of their meeting, the ITER Council "noted the Director's concern over the possible effects on the JCT (ITER Joint Central Team) should there be no positive indications regarding ITER's post EDA future and asked the Parties to take this concern into account in planning their decision-making process." Nevertheless, privately, members of the ITER Joint Central Team are preparing for the possibility of a 1-3 year "transition" period while the Parties' governments iron out the construction agreement, including cost sharing formula, site selection, and management structure.

According to an article in the February 23 edition of the San Diego Union-Tribune, White House Science Advisor, Jack Gibbons, told the recent annual meeting of the American Association for the Advancement of Science, "My own conjecture is that ITER may be postponed but not cancelled." He said that "The Congress has cut that (fusion) budget down at a level that is going to make it very difficult for us to be full participants in the construction of the ITER project."

FESAC REVIEWS

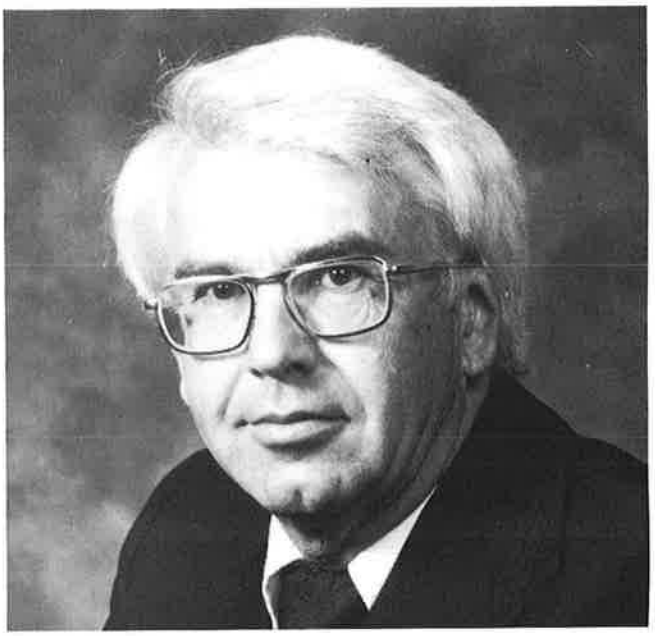
The DOE Fusion Energy Sciences Advisory Committee (FESAC) meets April 17-18 in the DOE Auditorium Building, Germantown, MD, to complete the U.S. national review of the ITER Detailed Design Report, issued December 1996. The meeting is open to the public. Persons wishing to make public comment should contact Al Opdenaker: albert.opdenaker@mailgw.er.doe.gov/ Another ITER-related FESAC review has begun under the chairmanship of Herman Grunder, Thomas Jefferson National Accelerator Facility. That panel will consider the potential role of the U.S. in the ITER construction phase. They will report later this summer. Opinions can be sent to Grunder at Grunder@cebaf.gov/

PHYSICS TODAY LETTERS

The editors of Physics Today published letters from three fusion critics in their March issue. The editors provided the provocative headline "Insurmountable Engineering Problems Seen as Ruling Out Fusion Power to the People in the 21st Century." Several letters rebutting the critics have been sent to Physics Today. They can be found on the new national fusion web page: http://www.fusionscience.org/ in the "Policy Information" subheading. The letters include one from Fusion Power Associates president Steve Dean who likened the critics to those who predicted that the automobile would never replace the horse because autos were always breaking down and getting stuck in the mud.

TFTR COUNTDOWN

The Tokamak Fusion Test Reactor (TFTR) at the Princeton Plasma Physics Laboratory (PPPL), will shut down in the near future due to congressional budget cuts. TFTR has been one of the most prolific producers of scientific results in the history of the U.S. fusion program, in addition to producing record advances in achieving fusion conditions in the laboratory. Our hats are off to the dedicated scientists and engineers at PPPL and elsewhere who have achieved so much with this facility. Special thanks should go to Dale Meade, who provided much of the early guidance and direction of the project, and to current TFTR leader Rich Hawryluk, who has kept the team focused on scientific excellence in the face of budgetary politics. Web browsers would be richly rewarded by accessing the following TFTR-related web page: http://www.pppl.gov/TFTR/



Dr. T. K. Fowler

FOWLER BOOK PUBLISHED

Fusion pioneer Ken Fowler has just published a book, ***The Fusion Quest*** (The Johns Hopkins University Press), in which he combines stories of the history of fusion with non-mathematical descriptions of the complexities of plasma physics. In the Preface, Fowler says, "The Promethean quest for fusion energy, to capture the fire of the sun on Earth, has sometimes been called the greatest technological challenge of all time. Now, after four decades of research, controlled fusion has at last been demonstrated in the laboratory. Having been privileged to participate personally in much of this exciting science history in the making, I was delighted when the Johns Hopkins University Press approached me about doing this book to share the fusion story with others."

About the book, Wolfgang K. H. Panofsky, Director Emeritus, Stanford Linear Accelerator Center, says, "Fowler, an active participant in the quest to convert magnetic confinement fusion into a usable energy source, writes in a very personal style about the development of that effort, starting from its optimistic beginnings to its most unfortunate slowdown as a result of insufficient government support."

A color copy of the book jacket, with a description of the book contents and quotes from selected reviewers, can be accessed at the University of California, Department of Nuclear Engineering homepage: http://www.nuc.berkeley.edu/ucbne.html/ The book can be ordered ($29.95 plus $3.00 shipping, plus for Maryland residents 5% sales tax or Canadian sales tax of 7%) by calling 1-800-537-5487 or by mail, The Johns Hopkins University Press, Hamden Station, Baltimore, MD 21211.

U. S. - KOREA FORUM

A U.S. - Korea Forum on Fusion Science and Technology was held in Washington, DC, February 18-19, under the auspices of George Mason University's Center for Science, Trade, and Technology Policy. Attendees included the Honorable Linsu Kim, President of the Korean Science and Technology Policy Institute, the Honorable Boo-Sik Yi, Vice Minister of Science and Technology, Republic of Korea, Professor Duk-In Choi, President of the Korea Basic Science Institute, Professor Sook-Il Kwun, President of the Korean Physical Society, Dr. Kwan Rim, President of Samsung Advanced Institute of Technology, Dr. Saeyoung Ahn, President of the Korean-American Scientists and Engineers Association, and the Honorable KunMo Chung, Former Minister of Science and Technology, Republic of Korea.

U.S. attendees included James Decker, N. Anne Davies, and Mike Roberts (USDOE), Dave Baldwin (GA), Ron Davidson (PPPL), Steve Dean (FPA), Bob HIrsch (E-TEC), Barrie Ripin (APS), John Schmidt (PPPL), and Mike Saltmarsh (ORNL).

The meeting covered a broad range of U.S. and Korean fusion interests, with special attention being given to KSTAR, a multi-hundred million dollar tokamak being constructed in Korea, with technical advice and assistance from the U.S. (See our July 1996 newsletter.) In the closing session, Dr. KunMo Chung, said that he was confident that Korea can "contribute to the world pool of scientific knowledge (in fusion) and there is now a vision to do so." He said, "The Korean Fusion Program is a long-term vision where KSTAR will serve as a major experimental device for world-wide R&D prior to ITER."

PLASMA PROCESSING

Researchers George Collins (Australian Nuclear Science and Technology Organization) and Don Rej (Los Alamos National Laboratory) have put together, as Guest Editors, an outstanding issue the MRS Bulletin (August 1996) devoted to plasma processing. Copies of the issue may be requested by contacting the Materials Research Society, 9800 McKnight Road, Pittsburgh, PA 15237-6006; (412)367-3004; fax -4373; http://www.mrs.org/ The issue contains expert articles on Plasma Generation for Materials Processing, Use of Plasma Processing in Making Integrated Circuits and Flat Panel Displays, Modification of Polymeric Surfaces with Plasmas, Plasma Surface Engineering of Metals, Plasma-Immersion Ion Implantation, Intense Ion-Beam Treatment of Materials, and Materials Processing with Thermal Plasmas. For further information, contact Don Rej at drej@lanl.gov/

QUOTABLES

At the 1996 Energy and Environment Conference, Nobel Laureate (Physics) Burton Richter said, "The U.S. must take the lead in developing new, less polluting energy sources. This is necessary for the U.S. because it is needed for our environment, for our economy, and so we can sell these new energy systems to the world instead of buying from them. Fusion power is a good candidate for the future because it does not produce carbon dioxide. The U.S. needs to develop fusion, solar, and advanced fission reactors because of their favorable environmental characteristics. To say we can't do it is total nonsense. We're now only spending less than1% of annual energy costs on energy R&D. We need to double our energy R&D budgets. Global warming is a very serious problem, and we're now engaged in a great gamble over the world's environment. Federal R&D increases should be on long-term energy sources. Fusion should be a priority area. It is really stupid, after the massive investments we've made in fusion, and at a time when there are signs of success, that the U.S. is withdrawing and turning the programs over to the Japanese and Europeans. It is crazy!"

Nobel Laureate (Chemistry) George Olaf, speaking at the same conference, said, "Most of us would agree that we should leave the world as a better place than we found it. Man needs energy, and the only clear sources of unlimited energy are fission and fusion. We do have the means to develop these energy sources; we just need the will and the guts to do it. For the future, the most important priority is conducting energy research now. We must find long-term energy solutions. It is tragic that in budgetary actions we are cutting back our support for fusion research. When you consider the enormity of the energy problem, the amounts involved for fusion research are negligible. It would be very useful if the U.S. would spend a few percent of what it spends on fossil fuels, on energy R&D. This would not bankrupt the country. Energy research must have an absolute high priority now or sometime in the 21st century our standard of living will be greatly decreased."

AMEN!

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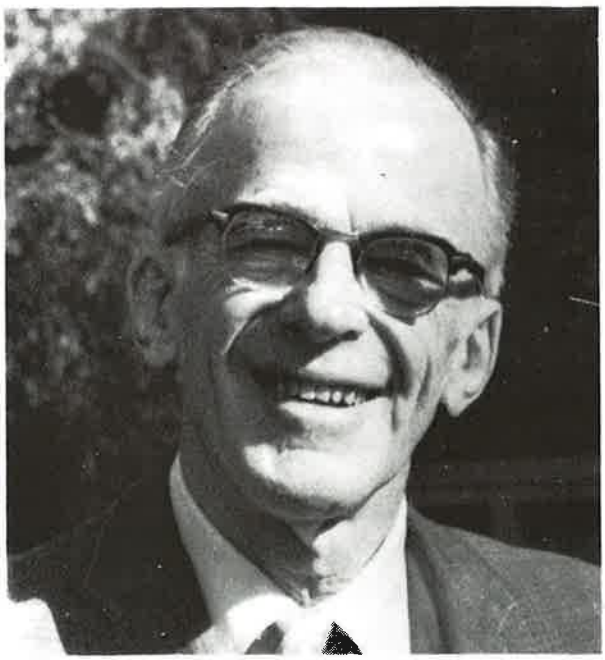
FUSION PIONEERS LYMAN SPITZER, JR. AND IGOR N. GOLOVIN PASS AWAY

IN MEMORIAM: LYMAN SPITZER, JR.

Lyman Spitzer, Jr., a founding father of fusion and plasma research in the United States, died suddenly April 7, at his home in Princeton, NJ. He was 82. Spitzer invented the Stellarator fusion concept in 1951 (USAEC Reports NYO-993 and 995, 1951) and began fusion research under the U.S. Atomic Energy Commission code name Project Matterhorn, at what was to become the Princeton University Plasma Physics Laboratory. Project Matterhorn work was classified secret, as was all fusion work, until the 1958 United Nations Conference in Geneva. He published a classic text, "Physics of Fully Ionized Gases" (1956), which was an early basic handbook used by plasma physicists and fusion researchers around the world. Stellarators are still widely studied, with billion-dollar class devices in operation or under construction in Japan and Europe, and smaller devices in the U.S. The Princeton Plasma Physics Laboratory closed down their stellarator in the early 1970's, converting it to the more popular tokamak configuration. Spitzer often mused on how he invented the stellarator while "riding the long chair lifts at Aspen."

Spitzer spent most of his career as a Professor in the Department of Astrophysical Sciences and Director of the Princeton Observatory at Princeton University. He was a prime mover in the development of the Hubble Space Telescope and devoted much of his time in recent years to analyzing its data. Earlier this year the Princeton University Press published a book entitled 'Dreams, Stars and Electrons: Selected Writings of Lyman Spitzer, Jr."

Spitzer received the National Medal of Science from President Carter in 1979. Among his many other awards, he received the 1978 Gold Medal of the Royal Astronomical Society, the 1980 Jules Janssen Medal of the Societe Astronomique de France, the 1985 Crafoord Prize of the Royal Swedish Academy, and was the first recipient of Fusion Power Associates Distinguished Career Award in 1987.



Prof. Lyman Spitzer, Jr.

IN MEMORIAM: IGOR N. GOLOVIN

As we are going to press we just learned of the death of Russian fusion pioneer Igor N. Golovin. He was 83. A leader of the fusion effort at the Kurchatov Institute in Moscow since its earliest days, Golovin was a colorful gentlemen who always had much to say about both technical and policy matters. The major magnetic mirror device at Kurchatov, the OGRA device, derived its name from the initial letters (reversed) of Artsimovich and Golovin (I.N. Golovin, Proc. Inst Elec. Eng. (London), Vol. 106A,Suppl. No. 2, 95, 1959). He also coined the term "tokamak." We join our Russian colleagues in mourning the death of one of the great men of our era.

ACADEMY REPORT ENDORSES NIF

The National Academy of Sciences (NAS) National Research Council has issued a report, "Review of the Department of Energy's Inertial Confinement Fusion Program," endorsing the

National Ignition Facility (NIF). The report is available on the web at http://www.nas.edu/cpsma/icf.htm

The report was prepared by a committee chaired by Prof. Steven E. Koonin of the California Institute of Technology (See our July 1996 newsletter). The committee has been meeting regularly since last August and has visited all the Inertial Confinement Fusion (ICF) sites. After abolishing its own internal ICF advisory committee in December 1995, DOE asked the Academy to review the ICF program in the context of their nuclear weapons Science-Based Stockpile Stewardship (SBSS) Program.

The report states that "the NIF would make important contributions toward the stated long-term goals of the SBSS program," and that "the science and technology have progressed sufficiently to allow the NIF project to proceed as planned." The panel said "The achievement of ignition appears likely, but not guaranteed. The steady scientific and technological progress in ICF during the 6 years since the last National Research Council review, the plausibility of ignition estimates based on the experimental and modeling results and capabilities in hand, and the flexibility of the facility all support the committee's finding that the NIF project is technologically and scientifically ready to proceed as planned with reasonable confidence in the attainment of its objectives."

A group of organizations opposed to nuclear weapons research, under the leadership of the National Resources Defense Council, has obtained a preliminary ruling from a U.S. Federal District Court judge, forbidding the DOE from "providing or obligating any (additional) funding, monies or other forms of support to the ICF Committee or the NAS for the purpose of supporting the ICF Committee as of today (March 5)" or from "utilizing, relying on or, in any way incorporating into its decision making process, the ICF Committee report or any other work product of the ICF Committee." The interveners claimed that the NAS committee violated the federal law governing federal advisory committees by not meeting in public session. The NAS contends that its committees are not bound by that law. The interveners also claimed that the members of the NAS committee were biased, by conflicts of interest, in favor of the ICF program. Shortly after the issuance of the injunction, the DOE issued a press release (March 11) that they had "approved the start of construction" of the NIF, stating that the NAS report "is not essential to, or required by, the Department as part of its policy and procedures for review and approval of construction of NIF." DOE is expected to have a groundbreaking ceremony in June. The interveners, for their part, have announced their intention to file a separate lawsuit challenging NIF construction, claiming an inadequate environmental impact statement.

SAN DIEGO UNION CHIDES GOVERNMENT

In its lead editorial on Sunday, April 13, the San Diego Union newspaper chides the U.S. government for "throwing away billions of dollars already spent on fusion energy research by cutting U.S. funding for an international project at its most critical juncture." They urged, "Leaders in Washington must look beyond the next political campaign or fiscal year and consider the world we'll leave our children and grandchildren. If we don't provide the basis for a new energy source to replace polluting, finite fossil fuels, we're condemning future generations to a declining economy, society and quality of life. All to save a few bucks today." They say that "The result will be that Japan and Europe will gain most of the benefits of the billions invested by American taxpayers to develop this energy source of the future."

The Union notes that "Government funding is crucial to fusion research because it will be decades before the energy source is commercially viable; private industry can't afford such a long-term commitment with no return on investment for 50 years. Japan and Europe understand that, but the United States does not." They comment, "Fossil fuels will eventually run out. And even scientists who aren't convinced about the greenhouse effect say the amount of carbon dioxide we're pumping into the atmosphere from burning fossil fuels is a problem. Alternative energy, such as wind and solar, can provide supplemental supplies but cannot fuel a planet. That's why we need fusion." They say, "Surely federal lawmakers can find a few million more in areas of the budget that aren't as crucial as the world's future energy supply."

WHITE HOUSE ENERGY PANEL NAMED

In response to the letter President Clinton sent to his science advisor Jack Gibbons January 16 (See our March newsletter), the White House Office of Science and Technology Policy issued a press release March 20 announcing the formation of a "Panel of Experts on Energy Research and Development." The panel will be headed by John Holdren, "The Teresa and John Heinz Professor of Environmental Policy and Director of the Program on Science, Technology and Public Policy at the John F. Kennedy School of Government" at Harvard University. The press release states that the panel "will provide recommendations on how to ensure the United States energy R&D program addresses the economic, environmental and national security needs of the nation for the next century." The release states that "Working with the White House Office of Science and Technology Policy and the U.S. Department of Energy, the panel will review current and projected U.S. energy R&D programs and will make recommendations on federal support for energy research and development, incentives for private-sector

investments in energy research and development and U.S. commitments to international cooperation in energy research and development. Issues covered by the panel will include R&D on energy and end-use efficiency, renewables, advanced fossil-fuel technologies, nuclear fission and nuclear fusion." The panel is due to report to the President by October 1.

Other members of the panel are: John Ahearne (Duke U.), Richard Balzhiser (EPRI), Joan Bok (New England Electric System), Robert Conn (UCSD), Thomas L. Fisher (Northern Illinois Gas Co.), William L. Fisher (University of Texas at Austin), Robert Frosch (Harvard University), William Fulkerson (University of Tennessee), Hal Harvey (The Energy Foundation), Dan Lashof (National Resources Defense Council), Diana MacArthur (Dynamac Corp.), Larry Papay (Bechtel Corp.), Don Paul (Chevron Corp.), Maxine Savitz (Allied Signal Corp.), Lillian Shiao-Yen Wu (IBM), Laura Andrea Tyson (University of California, Berkeley), Charles Vest (MIT), Virginia Weldon (Monsanto), Robert Williams (Princeton University), and John Young (Hewlett-Packard).

NEW GRANT OPPORTUNITIES

The DOE Office of Defense Programs has announced an Inertial Fusion Science Supporting Stockpile Stewardship Grant Program for "performance of unclassified innovative research in high energy-density science relevant to inertial fusion within the stockpile stewardship program. DOE expects to have up to $2 million available for this program in FY 1998. Any U.S. university or other institution of higher education or other non-profit or for-profit organization, non-federal agency or entity will be eligible for a grant award under this new program. A useful document, "Facility Use Plan of the National Ignition Facility (LALP-97-7) is also available. Applications are due June 30. Details can be found on the web at www3.dp.doe.gov/ifnif/grants.htm or by contacting Ann Satsangi, (301)903-8059, ann.satsangi@dp.doe.gov

The DOE Office of Fusion Energy Sciences has announced a new grant program for Innovations in Fusion Energy Confinement Systems for "innovative experimental research that has the possibility of leading to improved fusion energy power plants. Approximately $3 million in grants are planned. Applications are due May 15. Details can be found on the web at www.er.doe.gov and then clicking on "Grants and Contracts."

EUROPEAN ITER DESIGN REVIEW

The European Union has completed its review of the ITER Detailed Design Report (See our February newsletter). The report was prepared by a large committee chaired by Dr. R. Andreani, with separate subpanels on Physics (chaired by Derek Robinson), Engineering, including Cost and Schedule (chaired by R. Andreani) and Safety (chaired by J. Jacquinot).

The committee concluded that "The ITER parameters are commensurate with the stated objectives, and the design provides the requisite flexibility to deal with the remaining uncertainties by allowing for a range of operating conditions and scenarios for the optimisation of the plasma performance. In Engineering, while the machine structure presented in the DDR has been entirely defined and is fully responding to the operational requirements, work has to continue on a number of items, in particular remote maintenance and repair, to finalise the design and to complete the supporting R&D and prototype testing. Major improvements have been made to the safety analysis of ITER since the IDR (Interim Design Report, 1995). Further work should continue on occupational exposure and on consequences of the worst accident, not only to prepare for the licensing of ITER but also for its impact on demonstrating the potential benefits of fusion. No substantial change to the cost of ITER has been introduced between the IDR and the DDR. The construction time scedule seems optimistic."

U. S. ITER DESIGN REVIEW

The U. S. has completed its national review of the ITER Detailed Design Report. The report was prepared by a committee chaired by Bob Conn (UCSD) based on detailed reports from several subpanels.

Noting that the overall performance of ITER could be characterized by its "Q-value," where Q is the ratio of the fusion power to the external source of input power to the plasma, and that a Q of 5 "is a system in which the fusion plasma self-heating power from alpha particles (fusion products) equals the external source of plasma heating power, "the panel said that "ITER will be considered a scientific success if in the BPP (Basic Performance Phase) it demonstrates strong self-heating (say Q greater or equal to 10) of a long-pulse D-T (deuterium-tritium) plasma, although this will be a significant technological achievement as well." They comment that "ITER will be considered a technological success if in the EPP (Extended Performance Phase) it demonstrates reliable operation for an extended period (say about 10 years) with a neutron fluence of about 1 Megawatt per square meter. They say that "When combined with further improvements in plasma performance and plant availability, detailed studies suggest that the design of an attractive fusion DEMO power plant will be possible."

The panel congratulated the ITER designers for drawing "widely from the world tokamak experience-base" and for involving "experts world-wide." They said, "Our overall assessment is that the ITER engineering design represented in the DDR is a sound basis for the project to succeed."

With respect to the controversy over the projected performance of ITER (See our January 1997 newsletter), they said that "In the Panel's estimation, based on extrapolated tokamak confinement data, the expected performance of ITER's base operations mode ranges from that of fusion ignition (Q of infinity) to a moderately self-heating burning plasma (Q of about 4)." They said, "There is high confidence that ITER will be able to study long pulse burning plasma physics under reduced conditions (Q greater or equal to 4), as well as provide fundamental new knowledge on plasma confinement at near fusion-reactor plasma conditions. Achieving ignition is a reasonable but challenging goal."

The Panel said that they "would like to re-affirm the importance of the key elements of ITER's mission -- burning plasma physics, steady-state operation, and technology testing. The Panel has great confidence that ITER will be able to make crucial contributions en each of these areas."

ITER CITES INDUSTRY CONTRIBUTION

On March 27, U.S. ITER Home Team Leader Charles Baker presented an award to Martinez & Turek, Inc. for their contributions to the design and fabrication of tooling for manufacturing the U.S. prototype of a superconducting magnet for the ITER project. The Central Solenoid model coil will weigh 100 tons and will be the largest superconducting coil of its type in the world. The ceremony took place at the company's headquarters in Rialto, CA.

MAGNETIZED TARGET FUSION

One of the innovative concepts presented at a March 3-6 Innovative Confinement Concepts Workshop is called Magnetized Target Fusion (MTF), described as "a marriage of inertial and magnetic confinement." Scientists Irvin R. Lindemuth and Ronald C. Kirkpatrick, Los Alamos National Laboratory, have been spearheading this work in the U.S., but work is also in progress at LLNL, SNL and Phillips Laboratory in the U.S. and in Russia, France, England, and New Zealand as well.

The approach uses a magnetic field and a preheated, wall-confined plasma within an implodable fusion target. Although the approach is not new, the scientists state that "it is only in light of recent advancements in plasma formation techniques, implosion system drivers, plasma diagnostics, and large-scale numerical simulation capabilities that the prospects for fusion ignition using this approach can be evaluated." They note the existence of a 200 Megajoule pulsed power system in Russia that could provide a cost-effective facility for pursuing this approach. For additional information, contact Irv Lindemuth at irl@hayworth.lanl.gov

SCIENCE COMMITTEE BACKS FUSION

On April 16, the House Science Committee approved an authorization bill (H.R. 1277) containing $15 million more for fusion that requested by the President. The bill authorized $240 million per year for the next two years. The authorization bill will be debated in the full House within the next month and some attack on the fusion figure might be expected from environmental groups looking for more money for "renewable" energy technologies. However, the authorization bill is only a guideline for the Appropriations Committee bill which actually provides the money.

The following statements on fusion are contained in the House Science Committee report:

"The Committee provides an additional $15 million for the Fusion Energy Sciences program with the intent that these dollars be used for initiating and strengthening work in alternate confinement concepts; increasing utilization of the remaining two major experiments; strengthening and maintaining diversity in the theory and computational programs; and strengthening basic fusion sciences and technology in the university programs."

"The Committee remains strongly supportive of U.S. participation in international scientific endeavors. In this context, the Committee supports U.S. participation through the completion of the ITER Engineering Design Activity in July 1998. However, the Committee notes that to date; there is no official indication from the ITER project group itself or the participating parties what the end of the EDA might bring in terms of an agreement to go forward to construction. At the same time, there are indications there may be some interim period of as much as 2 to 3 years before a final design and construction agreement is in hand. While the Committee applauds the Department's call for a study of the ITER project by the National Academy of Sciences, it remains concerned that there is seemingly no plan to address this interim period. Therefore, the Committee asks that by February, 1998, the Department of Energy submit a plan to Congress that assumes level funding for the program and which addresses the following issues: 1) What, if anything, is the appropriate role of the U.S. fusion community in the ITER project after the completion of the EDA and prior to a construction agreement? 2) Given the importance of participation in the international fusion program to the U.S. fusion program, what other international activities should the U.S. seek to participate in during this interim period? and 3) What elements of the U.S. domestic fusion program should be strengthened and/or maintained in order to ensure that the U.S. has maximum impact on and leverage with the international fusion program in future years?"

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ROSENBLUTH RECEIVES NATIONAL MEDAL OF SCIENCE
FPA ANNUAL MEETING SET FOR AUGUST 27-29

FPA ANNUAL MEETING AND SYMPOSIUM: PATHWAYS TO FUSION POWER

Fusion Power Associates Annual Meeting and Symposium will be held this year in Snowmass Village, Aspen/Snowmass, Colorado, August 27-29. The theme of this year's symposium will be "Pathways to Fusion Power." The agenda for the symposium will provide for in-depth strategic discussions of the question, "How do we get from our present circumstance to some kind of practical product on some kind of schedule?" Topics to be addressed will include (1) What is our view of the nature (economics, regulatory, competing technologies) of the future marketplace in which fusion will compete? (2) Will fusion enter the commercial marketplace as an electric power producer, or as a supplier of some other needed product? (3) Can other fuel cycles compete with the deuterium-tritium cycle? (4) Which magnetic confinement concepts are most promising as commercial systems? (5) What are the commercial development issues for inertial confinement and its various driver options? and (6) Do fusion power plants really require low activation materials? Details will be forthcoming in a separate mailing, or contact Ruth Watkins at Fusion Power Associates.

CLINTON HONORS MARSHALL ROSENBLUTH WITH NATIONAL SCIENCE MEDAL

The White House announced April 30 that it would bestow the National Medal of Science on fusion scientist Marshall Rosenbluth. Rosenbluth will be one of nine recipients of what the National Science Foundation calls "the United States equivalent of the Nobel Prize." The announcement cites Rosenbluth "for his fundamental contributions to plasma physics, his leadership in the quest to develop controlled thermonuclear fusion, and his wide-ranging technical contributions to national security." The announcement says of Rosenbluth that "His theoretical studies of the behavior of plasmas and their instabilities provided a significant foundation for the design and development of prototype devices for fusion power." Rosenbluth began his career at the Los Alamos National Laboratory in the 1950's, working at first on the physics of the hydrogen bomb. He later joined a small group at Los Alamos that began to explore how to tame that bomb for peaceful purposes. He has been a leader in the fusion quest since that time and was a recipient of Fusion Power Associates Leadership Award in 1987. At a ceremony celebrating Rosenbluth's seventieth birthday last February, Russian fusion and space scientist, Roald Sagdeev called Rosenbluth "the best plasma physicist in the world."

Prof. Marshall Rosenbluth

Another scientist who made important contributions to fusion in its early days, Martin Schwarzchild of Princeton University, will also receive the National Medal of Science this year. He is cited "for his seminal contributions to the theory of the evolution of stars and his creative insights into the dynamics of galaxies." Schwarzchild passed away in April.

NIF CONSTRUCTION BEGINS

The Department of Energy held a groundbreaking ceremony May 29 at the Lawrence Livermore National Laboratory for the National Ignition Facility (NIF). The Laboratory called the NIF "a central element of the Department of Energy's Stockpile Stewardship and Management Program, which is designed to ensure the safety, security and reliability of the nuclear weapons stockpile without underground tests." When fully operational in 2003, the 192-beam, 2 million joule facility will be the world's largest laser and will produce, in a laboratory setting, conditions similar to those in the center of the Sun and other stars.

Groups opposed to the DOE's Stockpile Stewardship program sought unsuccessfully to stop the groundbreaking ceremony through a court injunction. The groups, led by the National Resources Defense Council, filed suit in early May, charging that DOE had failed to prepare an adequate environmental review of the nation's nuclear weapons complex and its associated facilities. The groups asked the court to block any new facilities or upgrades to existing facilities until an adequate review had been completed. DOE has in fact published a Programmatic Environmental Impact Statement for the weapons complex that it considers adequate to justify the NIF and other facilities. The federal judge declined to stop the groundbreaking ceremony while the matter is under judicial review.

REPRESENTATIVES SUPPORT FUSION

Led by Representatives Roscoe Bartlett (R-MD) and Tim Roemer (D-IN), seventy seven members of the U.S. House of Representatives (29 Republicans and 48 Democrats) from 17 states, wrote a letter to Rep. Joseph M. McDade, Chair of the Subcommittee on Energy and Water Development, House Committee on Appropriations, expressing their strong support for the U.S. Fusion program. They urged Dade's committee to provide funding "for no less than the Department's requested level of $225 million for FY 1998."

The letter said, "Right now, scientific progress towards harnessing fusion energy has never been more rapid or profound." They said that recent budget cuts, totaling 40%, "have slowed down important aspects of fusion and plasma research and have sent a negative signal to bright university students who might consider pursuing a career in this field." The representatives said that "The Fusion Energy Sciences program encompasses exactly the type of research the federal government should support -- fundamental science -- not ready for investment by the private sector, but with critically important long-term benefits. In particular, it ultimately promises to provide a safe, environmentally friendly and virtually unlimited energy source." They said that "the fusion program has already been cut to the point that important and productive facilities are being closed down. At this time, continuity and adequate resources are what the fusion research community needs to continue to be productive. We therefore urge you as Chairman of the Subcommittee on Energy and Water Development, to stop further cuts to the fusion budget and to provide for adequate funding of this very important program in Fiscal Year 1998."

A similar letter, signed by 80 representatives (including 3 from the Appropriations Committee who felt it inappropriate to sign the other letter), was sent to Rep. James Sensenbrenner, chair of the Committee on Science. The Science Committee recently reported out a bill recommending that $240 million, $15 million more than the President requested, be allocated to fusion in FY 1998.

Many members of the fusion community, under the dynamic leadership of Mark Haynes, VP, General Atomics Washington Office, participated in the effort to convince their representatives to sign this letter. For a complete list of the signatories, contact Mark (haynes@ga.radix.net).

ITER EXPLORERS FIRST REPORT

A group of government-designated officials from Europe, Japan, Russia and the U.S., called the ITER Explorers, have been engaged in non-binding discussions since last July with the aim of "reaching sufficient common understanding to expect that negotiations on possible arrangements toward ITER construction could converge in a reasonable time." Based on their discussions to date, they have issued an interim report, "Draft #1" of the ITER Explorers Report, dated April 23, 1997, which identifies tasks that need to be completed before decisions can be made regarding construction. They have provided 4 options as "possible approaches to the realization of ITER."

The first option is called "Complete Realization Agreement." It suggests that by July 1998, when the current agreement expires, the four Parties could conclude a comprehensive agreement for the implementation of construction and operation (covering a period of about 30 years). The agreement would be implemented through a series of staged protocols, the first of which would begin in July 1998 and cover a period of about 2 to 3 years, during which time the detailed design and R&D would be completed, the site would be designated and the cost-sharing arrangements would be finalized. The Explorers offer the opinion that this option is not likely to be realized before July 20, 1998 "given the present uncertainties."

The second option is called "Specific Transition Agreement." It suggests that by July 1998 the Parties could conclude a "stand-alone" agreement to "cover a transition period of about 3 years . . .to the signature of the complete realization agreement." The Explorers offer the opinion that "This option has the advantage that it could be conducted in the current general framework . . . ."

The third option is called "Extension of the EDA Agreement by About 3 Years," which by its name is self-explanatory. The Explorers offer the opinion that this option has "the advantage that negotiations on an extension could be minimal," and that this option "can likely be implemented by 20 July 1998, to ensure continuation of ITER activities."

The fourth option is called "No Joint Action," and states that this would "result in the end of the ITER joint activity" and leave any further actions up to individual Parties.

The draft report also discusses possible procedures for setting up an "ITER Legal Entity " (ILE) as a vehicle for implementing the construction phase of ITER. The report states that the ILE "can be established under international or domestic law by the Parties acting jointly or by one Party taking the initiative as a potential host."

The report notes "issues which remain to be discussed," including the "drafting of the legal instrument and supporting common understanding for the period following 20 July 1998 . . . . ;" the need to reach an understanding "on the level of resources to be provided by the Parties for the period following 20 July 1998;" and an understanding on how to adapt the "current structures and modes of operation of ITER activities in the period following 20 July 1998." The report concludes that "the key issues requiring further discussion are the following: (1) Site Determination and Hosting Provisions, (2) Cost Sharing, (3) Procurement Arrangements, (4) Intellectual Property Rights, (5) Facilitations and Privileges, and (6) Decommissioning Responsibilities." The Explorers say "These issues need to be addressed without delay." A final report to the ITER Council is due by February 1998.

The members of the ITER Explorers group are as follows. Europe: J. Routti, C. Massonier, E. Canobbio; Japan: N. Oki, T. Mamura, M. Yoshikawa, H. Satake, S. Tanaka; Russian Federation: E. Velikhov, Y. Sokolov, N. Cheverev, L. Golubchikov; U.S.: J. Decker, N.A. Davies, M. Roberts. For further information or a copy of the report, contact Mike Roberts (roberts@mailgw.er.doe.gov).

ITER TRANSITION PHASE WORK

During the three year transition period beginning 20 July 1998, the Explorers envisage many activities as follows: (1) evolution of the present design to account for specific site option(s), including cost estimates, safety and licensing at the site(s); (2) continuation of R&D, including prototype testing; (3) "finalizing procurement specifications and related documentation for ITER systems, taking into account industry capabilities;" (4) continue to consolidate the physics basis for ITER using domestic facilities; (5) develop "proposals on arrangements (ITER Legal Entity, management, organization, procurement, facilitations, etc.) for implementing the complete realization agreement if and when so decided; and (6) procure some long-lead-time items, such as superconducting strand.

JAPANESE NEWS REPORTS ON ITER

On April 24, the "Planning Committee to the Committee on Reformation of Financial Structure," a group formed by the Japanese Cabinet and three political parties in the Diet supporting the Prime Minister, met to discuss how to deal with the Japanese budget deficit. At the meeting the group discussed budget needs in the areas of education, science and technology. No official statement came out of these meetings, but news leaks resulted in headlines such as "Not Host ITER" and "Freeze Hosting ITER." The news reports stated that a majority of those present favored a freeze on any new large projects, including ITER, until the year 2000. Many of those present expressed the hope that by that time the fiscal situation would improve. Many also expressed the opinion that science and technology was so important that they should not be cut, although planned budget increases should be delayed. Since ITER planning does not envisage large budgets being required until at least the year 2000, these views do not necessarily impact planning for ITER in Japan. A group of very senior people, the Special Committee on the ITER Project, established by the Japan Atomic Energy Commission, is meeting and anticipates making recommendations to the government later this year. On May 15, newly-appointed Science and Technology Agency Minister Riichiro Chikaoka issued a statement that reads in part, "I can address clearly that our position of promoting the development of fusion energy, including ITER project, is not changed. The restructuring of the financial system of the government is also an important issue. However, according to my understanding of the importance of fusion energy as Japan's future energy source, I will continue my best effort to implement the ITER project very positively based on the recommendation of the Special Committee on ITER Project."

SANDIA UPS X-RAY RECORD

Sandia National Laboratories' Pulsed Power group continues to set new records for x-ray power and energy produced in the laboratory. Using the Particle Beam Fusion Accelerator II (PBFA-II), which was recently converted from ion beam to z-pinch configuration and renamed PBFA Z (See our June 1996 and January 1997 newsletters), scientists there produced 200 Terawatts, 1.9 Megajoules of x-ray output from an imploding cylindrical array of tungsten wires. One year ago, Sandia set a world record on the smaller Saturn facility of 85 Terawatts, 0.9 Megawatts. Experiments are now in progress enclosing the wire array with a canister (hohlraum) whose inside surfaces are coated with gold. The hohlraum provides containment of the x-rays, creating a high temperature x-ray bath for capsules containing fusion fuel. The x-rays then drive compression and heating of the pellet. For a technical report, "Z Pinches as

Intense X-Ray Sources for High Energy Density Physics Applications," contact Keith Matzen (mkmatze@sandia.gov). For general information on the Sandia Pulsed Power program, contact Jeff Quintenz (jpquint@sandia.gov).

FESAC AND OTHER REPORTS PUBLISHED

The December 1996 (Vol. 15, Nos. 3/4) issue of the Journal of Fusion Energy (Plenum Press) contains the following reports of the DOE's Fusion Energy Sciences Advisory Committee (FESAC): (1) "A Restructured Fusion Energy Sciences Program," Robert W. Conn et al., the January 1996 report of the FESAC to DOE Director of Energy Research, Dr. Martha Krebs; (2) "The Fusion Science Research Plan for the Major U.S. Tokamaks," James D. Callen et al., the March 1996 report of the Scientific Issues Subcommittee of FESAC; (3) "Alternative Concepts," Farrokh Najmabadi et al., the July 1996 report of the Alternative Concepts Review Panel of FESAC; and (4) "Report of the FESAC Inertial Fusion Energy Review Panel," John Sheffield et al.

The issue also contains the following reports of interest: (1) "Strategic Plan for the Restructured U.S. Fusion Energy Sciences Program," N. A. Davies; (2) "Outlook for Inertial Confinement Fusion," John H. Nuckolls; (3) "Industrial Opportunities on the International Thermonuclear Experimental Reactor (ITER) Project," W.R. Ellis; (4) "Recent Progress on the Tokamak Fusion Test Reactor," D. M. Meade; (5) "High Performance Discharges and Capabilities in Alcator C-Mod," Miklos Porkolab; and (6) "RF Plugging of Mirror Plasma," I.A. Kotelnikov and S.G. Kuzmin.

FUSION FACILITIES DIRECTORY

Fusion Power Associates is in the process of updating the "Fusion Facilities Directory," which is a compilation of information from most major fusion programs in the U.S. The Directory includes phone and fax information, logistic information for the site, and organization charts. Pre-publication orders are being accepted now. The cost for each directory is $30.00, which includes postage and handling. The cost of the Directory after its publication date (expected to be July 1, 1997) will be $50.00.

CALENDAR

June 23-27 Workshop on Current Topics Relating to Experiments in Laboratory and Space Plasmas, Maui, Hawaii. Contact: Walter Gekelman (ipels@physics.ucla.edu).

June 29 - July 2 11th IEEE International Pulsed Power Conference, Baltimore, MD. Contact: Gerald Cooperstein (cooperstein@nrl.navy.mil).

July 7-18 34th Culham Summer School in Plasma Physics, Culham, UK. Contact: J. Bright (julie.bright@ukaea.org.uk).

July 10-11 International Symposium on Plasma and Flow Simulation for Materials Processinn, Sendai, Japan. Contact: Kenichi Nanbu (ispfs97@ifs.tohoku.ac.jp).

July 17-22 23rd Conference on Phenomena in Ionized Gases, Toulousse, France. Contact: M. Bordage (icpig@cpa22.ups-tpse.fr).

July 21-25 4th International Conference on Laser Ablation, Asilomar, CA. Contact: R.E. Russo (rerusso@lbl.gov).

July 22-24 IAEA Technical Committee Meeting on Data Acquisition and Management for Fusion Research, Garching, Germany. Contact: F. Hertweck (hertweck@ippgarching.mpg.de).

July 23-29 20th International Conference on the Physics of Electronic and Atomic Collisions, Vienna, Austria. Contact: F. Aumayer (icpeac97@iap.tuwien.ac.at).

Jul 28 - Aug 1 Cryogenic Engineering and International Cryogenic Materials Conference, Portland, Oregon. Web page: www.orst.edu/groups/cec-icmc97/

Jul 29 - Aug 1 Workshop on Non-Neutral Plasmas, Boulder, CO. Contact: J. Bollinger (john.bollinger@nist.gov).

Aug 3-10 International Conference on Strongly Coupled Coulomb Systems, Boston College, MA. Contact: G.J. Kalman (kalman@bc.edu).

Aug 4-8 Seminar on Plasma Processing of Materials, Buenos Aires, Argentina. Contact: A. Rodrigo (rodrigo@cnea.edu.ar).

August 18-22 13th International Symposium on Plasma Chemistry, Beijing, China. Contact: Lin He (sctam@sun.ihep.ac.cn).

August 25-28 International Conference on Computational Physics: PC97, Santa Cruz, CA. Contact: Ann Lavallee (comp97@physics.ucdavis.edu).

Aug 27-29 Fusion Power Associates Annual Meeting and Symposium, **"Pathways to Fusion Power,"** Aspen/Snowmass, Colorado. Contact: Ruth Watkins (72570.707@compuserve.com).

Sep 4-12 International Workshop on Diagnostics for Experimental Fusion Reactors, Varenna, Italy. Contact D. Pifferetti (ccvm@ccvm.cil.lc.lc.it).

Sep 8-9 5th IAEA Technical Committee Meeting on Alpha Particle Physics in Fusion Research, JET, Culham, UK. Contact: J. Jacquinot (jgj@jet.uk).

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EXECUTIVE NEWSLETTER

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AMASA S. BISHOP DIES AT 76
- FIRST U. S. FUSION PROGRAM DIRECTOR

IN MEMORIAM: AMASA S. BISHOP

Dr. Amasa S. Bishop, first director of the U. S. fusion program, died May 21, 1997 at his home in Switzerland. He was 76.

"Am" was Chief of the U. S. Atomic Energy Commission's Controlled Thermonuclear Branch, Division of Research, from 1953 to 1956. He then became the AEC's European Scientific Representative. As plans evolved for the declassification of fusion research worldwide at the International Atomic Energy Agency's 1958 Conference on the Peaceful Uses of Atomic Energy, Bishop was asked to write a book that could be released at the time of the conference. That book, Project Sherwood - The U. S. Program in Controlled Fusion (Addison-Wesley, 1958), became the inspiration for many students who entered the field from the late 1950's to the present day. It discussed, in simple terms, the many concepts under investigation and traced the history of the U. S. program and its pioneer researchers from the inception of the U. S. program in 1951. His book is still one of the best introductions to fusion.

In 1961, Bishop returned to the U. S. and took a research position at the Princeton Plasma Physics Laboratory, where he did spectroscopy experiments on the Model C Stellarator. In January 1966, with the fusion program under intense scrutiny by the Congressional Joint Committee on Atomic Energy, he was summoned back to again head the U. S. program at the Atomic Energy Commission. His first action was to prepare, with the assistance of then staff member Steve Dean and Dick Post of LLNL, the "AEC Policy and Action Paper on Controlled Thermonuclear Research." This document, delivered to Congress in the Spring of 1966, provided U. S. program policy and planning guidance for the rest of the decade. In 1968, Bishop hired Bob Hirsch to replace Steve Dean, who was transferring to the U. S. Naval Research Laboratory to start an experimental plasma research program there using high power

Dr. Amasa S. Bishop - 1958

lasers. Hirsch later became U. S. fusion program director and orchestrated the rapid program buildup in the mid-1970's.

In 1970, Bishop once again left the AEC and the fusion program and joined the United Nations as Director of Environment for the U. N. Economic Commission in Europe. He was based in Switzerland and was to spend the rest of his life there. He was an avid skier, a man of boundless energy and optimism, and rarely was known to rest. He put as much enthusiasm and energy into his vacations and family as he put into his work. While in Washington in the 60's, he and his wife Barbara and daughter Jennifer hosted legendary social events at their large home in Bethesda, MD. On hearing of Bishop's death, former head of the Los Alamos fusion program Fred Ribe commented, "I am sorry to hear that Amasa is gone. He was a classy guy who gave fusion research a good name."

Bishop maintained occasional contact with the fusion effort over the years. He was a supporter of Fusion Power Associates as an

Individual Affiliate and has periodically sent us letters responding to articles in our newsletters or alerting us to an event in Europe. In 1992, he was a recipient of Fusion Power Associates Distinguished Career Award.

Amasa Bishop was born in Cleveland, OH, graduated from the California Institute of Technology (B.S. Physics, 1943) and earned his Ph.D. degree in Physics (1950) from the University of California at Berkeley. From 1943-1946 he performed radar research at the MIT Radiation Laboratory and from 1946 -1950, he worked on high energy physics at the University of California Radiation Laboratory. He is survived by his wife, Barbara, who lives at their home at Les Acacias, 1261 Genolier, Switzerland, three sons, one daughter and a brother.

NEW AFFILIATE

Coleman Research Corporation, Springfield Virginia, has joined Fusion Power Associates as an Affiliate. Coleman is a subsidiary of Thermo Electron Corporation. Tony Slotwinski, Senior Photonics Scientist, will represent the company. He can be reached at 6551 Loisdale Ct., Suite 800, Springfield, VA 22150-1808; (703)719-9200; fax -9221; email: tony_slotwinski@mail.crc.com

The company has developed and produced a series of laser-based high precision measuring systems which are used to determine three-dimensional coordinates of large-scale objects and arrays of targets. They are working with Oak Ridge National Laboratory to develop a radiation-hardened version of this instrumentation for application in fusion devices such as the International Thermonuclear Experimental Reactor (ITER). The patented technology is based on coherent detection of a swept frequency, large bandwidth (100 Ghz), modulated laser. The systems are currently used commercially in the manufacture of aircraft and in the construction of highway bridges.

PEÑA ON NIF

Speaking at the groundbreaking ceremony for the National Ignition Facility (NIF), May 29, Energy Secretary Federico Peña said, "NIF will unleash the power of the heavens to make Earth a better place." In his prepared speech, Peña said "The project we break ground for today will house a 192-beam laser. It will be the world's largest, delivering 1.8 million joules that will ignite a tiny fusion target. The laser will be housed in a building that will rise seven stories at its highest points and stretch the length of two football fields. This is an ambitious endeavor. This is an important endeavor. The National Ignition Facility has been designed to create -- for the first time ever in a laboratory -- brief bursts of self-sustaining fusion reactions. These are the kinds of reactions that power the sun and the stars." Peña said, "NIF will attract a new generation of scientists and engineers to plasma and fusion physics. This facility will be a unique and valuable laboratory that will enable scientists, current and future, to see what they can accomplish with a one-billionth scale star to work with in the laboratory." He added, "Our nation's future depends on our continued leadership in science and technology. Today we move one step closer to a better future."

WHITE HOUSE ENERGY PANEL UPDATE

The Panel on Energy R&D of the White House Office of Science and Technology (See our May newsletter) is making good progress toward delivering a report to President Clinton by its October deadline. The Panel, chaired by John Holdren, Harvard University, has divided itself in several Task Forces. Fusion is being considered by the Nuclear Task Force, chaired by John Ahearne of Duke University. The Task Force received a day of briefings on fusion May 20 from Mike Knotek (formerly Batelle PNL), Dave Baldwin and Tom Simonen (GA), Stewart Prager (U. WI), Miklos Porkolab and Bruno Coppi(MIT), John Schmidt and Rob Goldston (PPPL), Charlie Baker (UCSD) and Mike Mauel (Columbia U.). The Task Force is meeting June 25-28 in San Diego. Fusion presentations are scheduled by Roger Bangerter (LBNL), Mike Campbell (LLNL), Steve Dean (FPA), Bill Ellis (Raytheon) and John Davis (McDonnell Douglas). They also have a meeting scheduled July 14 in Washington, when they are scheduled to hear from ITER director Robert Aymar and fusion representatives from Europe and Japan.

Comments and opinions can be sent to John Ahearne by email (ahearne@sigmaxi.org).

INVESTING IN INNOVATION

A 27-page interim report entitled "Investing in Innovation," from a bipartisan federal advisory group, the Competitiveness Policy Council (CPC), is available on the web (http://www.ksg.harvard.edu/iip/techproj/home.html). The report stresses the usefulness of public-private partnerships, encourages experimentation, and urges a greater state and regional role in federal technology activities. It recommends that six principles guide federal technology policy: (1) encourage private innovation, (2) emphasize basic technology research, (3) make better use of available technology, (4) use all policy tools, not just R&D support, (5) leverage globalization of innovation, and (6) improve government effectiveness. Under principle #2, the report says, "R&D agencies should receive strong support for their investments in basic technology research as well as basic science." Under principle #4, the report says the government

should use its full range of mechanisms, including tax incentives, regulatory reform, standards, and intellectual property rights, as well as direct federal funding of R&D." Under principle #5, it urges government to take "an active role in defining the forms of transnational technological collaboration." Under principle #6, it urges a pluralistic system of sources of support and cautions Congress to be "an active, but patient and sophisticated, participant."

KILKENNY NAMED TO LLNL LASER POST

Joe Kilkenny has been named deputy associate director for ICF/NIF and High Energy Density Experimental Science at LLNL, reporting to Associate Director for Lasers, Mike Campbell. In his new position, Joe will have line management responsibility for the overall coordination and direction of the inertial confinement fusion program (ICF) and the National Ignition Facility (NIF) project. He will also ensure that the necessary science and technology support for the programs are obtained.

Joe received his Ph.D. in experimental plasma physics from Imperial College, London University, in 1972. He started work on laser plasmas at Imperial College and Rutherford Laboratory in the early 1970's and left England for LLNL in 1983. He is a fellow of the American Physical Society and a co-recipient of their 1995 Excellence in Plasma Physics Research Award.

LOCKHEED MARTIN ITER COIL PROGRESS

U.S. industrial responsibility for constructing a superconducting model central solenoid (CS) coil rests with Lockheed Martin Corporation, San Diego, CA. That work is moving along, with the successful accomplishment of several intermediate milestones. Two critical fabrication steps were recently demonstrated, one for the welding of the tension plates that secure the conductor at each end of the coil layers, and one for the application of turn insulation to the conductors.

Lockheed Martin also completed the two-in-hand inner (first) layer of the U. S. CS Model Coil module early in April, after winding, bending and positioning the leads, and welding the tension plates to each of the four leads. The module was shipped to the MIT Hingham plant, for fabrication of the terminations. After the terminations were completed, the module was sent to Dayton, OH, where it was vacuum treated.

INDUSTRY VIEWS ON ITER

Fusion Power Associates recently completed a survey of 34 U.S. firms, questioning them on their views on the International Thermonuclear Experimental Reactor (ITER) project. A copy of the report is available from Fusion Power Associates. A summary of the report is presented below.

Fusion development is at the forefront of many important technologies. Research on fusion has already provided the scientific and technological underpinnings for many existing and near-term commercial applications, such as plasma processing of semiconductor chips, with world markets valued at many tens of billions of dollars per year. Unless U.S. industry is afforded an opportunity to be involved in ITER, it is likely that others will reap disproportionate benefits, not only in these near-term markets, but also as suppliers of fusion power plants in the future.

The design of a fusion demonstration power plant requires data on plasma performance under power-producing conditions, and engineering data on facility operations and reliability in a fusion environment. The current generation of existing fusion facilities cannot be upgraded to provide this essential information. Consequently, the industries surveyed view ITER as an essential step in the international effort to develop this important new future energy source. International collaboration, including international industrial collaboration, is appropriate, provided there is equitable sharing of information. International collaboration reduces the costs of fusion development, and this is important in this time of budget stringency. A primary concern of U.S. industry is the faltering U.S. government commitment to fusion energy development. The U.S. should be an equal participant in ITER construction and thereby provide U.S. industry with an equal opportunity to contribute and to benefit.

Industry recognizes the important science to be done in ITER. But ITER is more than a scientific experiment. It is a large, complex engineering device that requires the extensive experience of industry for its construction and operation. Among the many roles that industry might play in the ITER construction phase, industry places the highest priority on participating in hardware fabrication, completion of ITER research and development, and the protection of U.S. industrial interests and core competencies in high technology areas. U.S. industry has the technical capability to contribute to ITER and is looking forward to participating.

The level of federal investment in fusion and other alternatives to fossil fuel based power systems is woefully inadequate, given the magnitude of the societal impact, in the long term, of failure to find adequate environmentally acceptable energy sources. Trillions of dollars of capital investment during the twenty-first century will be devoted to building power plants. Americans currently spend over $400 billion per year for gasoline and electricity, almost all of which consumes fossil fuels, whereas

the Department of Energy currently spends less than $1 billion per year on fossil fuel replacement technologies, including only about $225 million per year on fusion. The federal government should seriously reexamine the long-term consequences of this under-investment strategy.

SOME REMINDERS:

FPA ANNUAL MEETING AND SYMPOSIUM: PATHWAYS TO FUSION POWER

Fusion Power Associates Annual Meeting and Symposium will be held this year in Snowmass Village, Aspen/Snowmass, Colorado, August 27-29. The theme of this year's symposium will be "Pathways to Fusion Power." The agenda for the symposium will provide for in-depth strategic discussions of the question, "How do we get from our present circumstance to some kind of practical product on some kind of schedule?" Topics to be addressed will include (1) What is our view of the nature (economics, regulatory, competing technologies) of the future marketplace in which fusion will compete? (2) Will fusion enter the commercial marketplace as an electric power producer, or as a supplier of some other needed product? (3) Can other fuel cycles compete with the deuterium-tritium cycle? (4) Which magnetic confinement concepts are most promising as commercial systems? (5) What are the commercial development issues for inertial confinement and its various driver options? and (6) Do fusion power plants really require low activation materials? For information contact Ruth Watkins at Fusion Power Associates.

FUSION FACILITIES DIRECTORY

Fusion Power Associates is in the process of updating the "Fusion Facilities Directory," which is a compilation of information from most major fusion programs in the U.S. The Directory includes phone and fax information, logistic information for the site, and organization charts. Pre-publication orders are being accepted now. The cost for each directory is $30.00, which includes postage and handling. The cost of the Directory after its publication date (expected to be August 1997) will be $50.00.

CALENDAR

July 21-25—4th International Conference on Laser Ablation, Asilomar, CA. Contact: R.E. Russo (rerusso@lbl.gov).

July 22-24—IAEA Technical Committee Meeting on Data Acquisition and Management for Fusion Research, Garching, Germany. Contact: F. Hertweck (hertweck@ippgarching.mpg.de).

July 23-29—20th International Conference on the Physics of Electronic and Atomic Collisions, Vienna, Austria. Contact: F. Aumayer (icpeac97@iap.tuwien.ac.at).

Jul 27-Aug 1—Topical Conference on Shock Compression of Condensed Matter. Amherst, MA. Contact Alita Roach (alita@lanl.gov).

Jul 28 - Aug 1—Cryogenic Engineering and International Cryogenic Materials Conference, Portland, Oregon. Web page: www.orst.edu/groups/cec-icmc97/

Jul 29 - Aug 1—Workshop on Non-Neutral Plasmas, Boulder, CO. Contact: J. Bollinger (john.bollinger@nist.gov).

Aug 3-10—International Conference on Strongly Coupled Coulomb Systems, Boston College, MA. Contact: G.J. Kalman (kalman@bc.edu).

Aug 4-8—Seminar on Plasma Processing of Materials, Buenos Aires, Argentina. Contact: A. Rodrigo (rodrigo@cnea.edu.ar).

August 18-22—13th International Symposium on Plasma Chemistry, Beijing, China. Contact: Lin He (sctam@sun.ihep.ac.cn).

August 25-28—International Conference on Computational Physics: PC97, Santa Cruz, CA. Contact: Ann Lavallee (comp97@physics.ucdavis.edu).

Aug 27-29—Fusion Power Associates Annual Meeting and Symposium, **"Pathways to Fusion Power,"** Aspen/Snowmass, Colorado. Contact: Ruth Watkins (72570.707@compuserve.com).

Sep 4-12—International Workshop on Diagnostics for Experimental Fusion Reactors, Varenna, Italy. Contact D. Pifferetti (ccvm@ccvm.cil.lc.lc.it).

Sep 8-9—5th IAEA Technical Committee Meeting on Alpha Particle Physics in Fusion Research, JET, Culham, UK. Contact: J. Jacquinot (jgj@jet.uk).

Oct 6-10—50th Annual Gaseous Electronics Conference. Madison, WI. Contact Pat Gaitan (gaitan@admin.uwex.edu).

Oct 6-10—17th IEEE/NPSS Symposium on Fusion Engineering. San Diego, CA. Contact Theresa Siegrist (theresa.siegrist@gat.com) or visit the conference web site (http://aries.ucsd.edu/SOFE97).

Oct 20-23—IAEA Technical Committee Meeting on Innovative Approaches to Fusion Energy. Pleasanton, CA. Contact Gloria Davalos (davalos@llnl.gov).

Oct 26-31—8th International Conference on Fusion Reactor Materials. Sendai, Japan. Contact: ICFRM8@fusion.imr.tohoku.ac.jp or visit web site (http://www.icfrm8.nucle.tohoku.ac.jp).

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EXECUTIVE NEWSLETTER

FUSION POWER ASSOCIATES
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GOLDSTON NAMED PRINCETON DIRECTOR

NEW AFFILIATE

Wah Chang, an Allegheny Teledyne Company, has joined Fusion Power Associates as an Affiliate. Wah Chang is a major producer of specialty metals and chemicals used primarily in energy production; chemical and mineral processing; aerospace; and in medical, research and consumer products. Their materials include zirconium, niobium, hafnium, titanium, vanadium, silicon, tetrachloride, and zirconium and hafnium chemicals. Thomas E. Cordier, VP, Marketing and Product Development, will represent the company. He can be reached at P. O. Box 460, Albany, OR 97321; (541)926-4211, ext. 6207; fax (541)967-6990. We welcome Wah Chang's participation in Fusion Power Associates.

GOLDSTON NAMED PPPL DIRECTOR

Robert J. Goldston, professor of astrophysical sciences at Princeton University and associate director for research at Princeton Plasma Physics Laboratory (PPPL) became the fifth director of PPPL on July 1. He succeeds Ronald C. Davidson, who resigned the position last December 31. John A. Schmidt has served as Interim Director since that time.

Princeton University President Harold T. Shapiro issued a statement saying, "Rob Goldston is exactly the right person to lead PPPL and, in that capacity, to play a central role in the national and international magnetic fusion efforts at a time of new directions and innovation in this exciting field of research. In addition to being a scientist of the highest stature, he is known within the field as a person of vision, a gifted communicator, and a leader committed to forging effective partnerships among individual scientists and diverse institutions in support of a truly national, even international, research enterprise."

Secretary of Energy Federico Peña commented, "PPPL is one of the Department of Energy's premier research institutions. It's our only laboratory devoted to plasma physics, a scientific discipline important not only to long-range fusion energy research, but also to nearer-term issues in semiconductor processing, astrophysics and waste management. I'm pleased that Professor Goldston brings such scientific accomplishment to this position of leadership within the U. S. fusion program. I look forward to working with him in sustaining a strong U. S. fusion science program into the 21st century."

Dr. Robert J. Goldston

Princeton University Provost Jeremiah Ostriker, who led the search for the new PPPL director along with physics professor and chair of the University Research Board William Happer, said, "Rob Goldston's scientific accomplishments demonstrate that he is extremely well qualified for this position of leadership at PPPL and within the larger magnetic fusion community. He also happens to be one of those rare individuals who can describe a research vision in terms that elicit the respect and cooperation of scientists and nonscientists alike. I have no doubt that, under his leadership, PPPL will continue to play a

central role in a collaborative national and international effort to deepen the understanding of hot plasmas and to make fusion energy a practical reality. We are fortunate to have him assume the directorship of the lab at this critical juncture in its history."

Rob received his Ph.D. in astrophysical sciences from Princeton University in 1977 and has worked at the University and at PPPL since that time. He is the author of over 200 scholarly articles and is co-author with Paul Rutherford of the textbook, "Introduction to Plasma Physics." He has worked on all the major programs at PPPL, including the Adiabatic Toroidal Compressor (ATC), the Princeton Large Torus (PLT), the Poloidal Divertor Experiment (PDX), and the Tokamak Fusion Test Reactor (TFTR). For his latter work, he was co-recipient of the American Physical Society's Excellence in Plasma Physics Award.

Recently, he has been active in identifying "innovations" for the national fusion program and been working with the team of scientists designing the new National Spherical Torus Experiment (NSTX), which will begin construction later this year at PPPL. The mission of the NSTX is to develop the physics basis for a more compact fusion power source, with a lower cost development path to commercial application.

Goldston issued a statement saying, "The study of the physics of hot plasmas is one of the most rewarding fields of scientific research. Plasmas are full of wonderful and surprising tricks that fascinate us as scientists, and at the same time the goal of providing a sustainable and clean energy source for future generations provides a fundamental motivation for our hard work." Speaking later to a reporter for the Trenton Times, Goldston said, "I think this is good stuff, what we do, important stuff, and a big part of what developed countries owe the rest of the world. If you are going to have a rich civilization, in every meaning of the word, you are going to need energy. And if we developed nations burn up all the fossil fuels and don't provide the world with something new, its not fair. And of course, the science is also fascinating." We wish Rob every success in his new position.

PPPL STAFF REDUCTIONS

New PPPL director Rob Goldston's first official duty was an unpleasant one. He confirmed and announced the layoff of 35 employees in anticipation of a 15% budget cut from the Department of Energy for Fiscal Year 1998. Prior to the announcement, about 80 persons agreed to a voluntary early retirement program. About 45 subcontractor employees will also be terminated. The reductions will bring the total number of regular employees at PPPL down to about 400.

ITER ACADEMY STUDY ON HOLD

Lawyers for the Department of Energy and the National Academy of Sciences could not agree on the terms for an "assessment of the scientific merit of the International Thermonuclear Experimental Reactor (ITER) program," requested last March by DOE Director of Energy Research Martha Krebs (see our April 1997 issue). It now seems unlikely that the Academy study will take place. Sources indicated that the problem was that the Academy wished to conduct the study in secret, whereas recent court decisions have ruled that they must engage in a more open process. The Academy is appealing the court rulings. In a recent example (see our April 1997 issue), a federal court enjoined the Department of Energy from "relying on or in any way incorporating into its decision making process the (Academy's) ICF Committee report or any other work product of the ICF Committee." Since DOE pays the Academy to conduct these studies, DOE lawyers did not want to get into a situation of being unable to use the ITER study results when completed. For their part, Academy lawyers were unwilling to carry out the study in a more open fashion, fearing it would set a precedent.

FESAC ITER REVIEW PROCEEDS

Recently the DOE's Fusion Energy Sciences Advisory Committee (FESAC) gave its general approval to the ITER design (see our May 1997 issue). Now another FESAC panel has begun a study to address the topic of U. S. participation in an ITER construction phase, assuming the ITER Parties decide to proceed with construction. The panel, which held its first meeting July 17-18 in San Diego and will hold a second meeting August 8-9 in Washington, is being chaired by Hermann Grunder director of the Thomas Jefferson National Accelerator Facility, Newport News, VA.

The panel will advise DOE on "criteria for a decision on the level and nature of U. S. participation in ITER construction" and also in a recently proposed "transition period to last three to five years." The current phase of the international ITER agreement will be completed in July 1998. The DOE asked the FESAC to provide "relative importance among the criteria," and "some possible scenarios for U. S. participation in ITER construction activities and what would be the priority among the various activities." DOE asked FESAC for a letter report by the end of October 1997 and for a final report by mid January 1998.

At its July 17-18 meeting, the panel heard presentations from DOE fusion program director N. Anne Davies, ITER director Robert Aymar, U. S. ITER Home Team Leader Charles Baker, W. Stacey of Georgia Institute of Technology, Bill Ellis of Raytheon, and Ned Sauthoff and Rip Perkins of PPPL.

LOCKHEED MARTIN HONORED

Lockheed Martin Corporation, San Diego, CA, was honored July 7, 1997, by the U. S. ITER Home Team for their work on the ITER superconducting model central solenoid coil. U. S. ITER Home Team Leader, Dr. Charles C. Baker, presented the award, saying that it was "in recognition of outstanding design and fabrication efforts in overcoming the many first-of-a-kind complexities and challenges in the manufacture of the large niobium-tin superconducting Central Solenoid Model Coil Module."

Lockheed Martin President and CEO, Vance D. Coffman, accepted the award, saying "We at Lockheed Martin believe this critical international program should be embraced by all Americans." He noted that the U. S. government, after initiating the ITER effort, has recently "stepped back from that commitment." He said, "The issues involved in balancing the federal budget are well known, and I won't raise those issues here. But I will point out that our international partners face similar funding pressures and they have lived up to their commitments. The United States should fulfill its original obligations to this critical, international scientific effort." He commented that the "U. S. needs scientific breakthroughs from ITER--and similar programs--if we are to solve the environmental challenges we face. Our country finds itself on a collision course with the future. We want the benefits that economic growth brings, yet we are unwilling to accept the environmental cost that such growth usually entails. Fusion-generated electricity should provide one way out of that dilemma. It promises to be a safe and clean source of energy. Furthermore, fusion has a virtually unlimited energy source--which means it will also serve the long-term national security interests of the United States." He concluded by saying, "My hope is that the Congress and the Administration will return the U. S. to being a full partner in that future--and reap the long-term benefits of our partnership." Congressman Randy "Duke" Cunningham proclaimed July 7, 1997, "Lockheed Martin Appreciation Day in the cities and communities of California's 51st Congressional District."

The central solenoid (CS) provides the majority of the magnetic flux change needed to initiate the plasma, generate the plasma current and maintain this current during the burn time. It contributes towards the fields needed to confine the plasma, but is not used for plasma control. It supports a large fraction of the centripetal force from the toroidal field coils, which in turn support part of the radially outward load on the CS. The technology required to build the CS represents a significant advance on that existing today for conductor manufacture. The objective of the CS program is to develop magnet technology to a level which will allow the full scale ITER CS to be built with confidence.

By July 1998, the central solenoid model coil fabrication project will have resulted in the production of 25 tonnes of niobium-tin superconductor, provided by 7 vendors; 6000 meters of superconducting cable will have been jacketed in incoloy 908, ant CS model coil fabrication will have been completed and be ready for testing by the international community. The supporting R&D program will have tested short lengths of conductor to 12 T steady state and to 5 T pulsed, and will have demonstrated the full performance for conductor strands and subcables. The CS model coil will be the world's largest and highest field pulsed superconducting magnet test facility and may have applications beyond fusion. For further information, contact Bruce Montgomery (dbm@pfc.mit.edu) or John Wohlwend (john.wohlwend@mmcado.com).

HEAVY ION INERTIAL FUSION SYMPOSIUM

The 12th International Symposium on Heavy Ion Inertial Fusion is scheduled for September 24-27, 1997 in Heidelberg, Germany. The site will be the University in the center of old Heidelberg, and the conferees will be housed in a number of surrounding hotels within walking distance. The conference is organized jointly by GSI Darmstadt and the Research Center Karlsruhe (FZK). In addition to providing broad coverage of progress in the science and technologies of heavy ion fusion, a highlight of the conference will be the first report from the European Study for a Heavy Ion Driven Inertial Fusion Facility (HIDIF). The study has been underway since 1995. For detailed information on the conference, including registration, contact Mrs. G. Eisold at GSI by email (symposium@gsi.de) or visit the web site (http://www.gsi.de/~hidif/hifsymp/home.html).

THE HIGH COST OF OIL

In an article, "Persian Gulf Myths," in the latest issue of Foreign Affairs, two former U. S. intelligence officials estimate that the United States spends as much as $60 billion a year to defend oil in the Persian Gulf worth $30 billion a year. Graham E. Fuller, former vice chairman of the CIA's National Intelligence Council, and Ian O. Lesser, former member of the State Department's Policy Planning staff, say "Americans pay what amounts to a substantial hidden gasoline tax" because of the high cost of defending such foreign oil sources. Meanwhile, the Department of Energy's Energy Information Administration, in its annual report for 1997, says that U. S. dependency on oil imports is estimated to increase to as much as 68 percent of total demand by the year 2015. This compares to recent import levels of around 50%. U. S. import dependence on OPEC nations has steadily increased from about 1.8 million barrels a day in 1985

to about 4 million barrels a day in 1995. The Energy Information Administration estimates this will rise to about 6.8 million barrels a day by 2015. The American Petroleum Institute (http://www.api.org) announced that total imports of crude oil and petroleum products in April reached an all time high of 10.136 million barrels a day, surpassing the old record of 9.997 million barrels a day, set in February 1977. For further information, contact Dean Reed, Fuels for the Future, (202)223-3532.

IAEA ON NUCLEAR POWER

The International Atomic Energy Agency (IAEA), a United Nations organization based in Vienna, Austria, states that there were a total of 442 nuclear power plants operating around the world in 1996. Five new plants, representing about 6 GWe, came on line in 1996, two in Japan and one each in France, Romania and the USA. In April 1997 one more reactor came on line, in the Republic of Korea. Three new nuclear power plants began construction in 1996, two in China and one in Japan, bringing the total number of plants under construction around the world to 36 in 14 countries. Seventeen countries relied on nuclear power for at least a quarter of their total electricity needs, the highest being Lithuania (83%), France (77%), Belgium (57%), and Sweden (52%). In the U. S., 22% to total electricity was supplied by nuclear power in 1996. Overall, nuclear power plants provided approximately 17% of the world's electricity in 1996. A detailed table is available from the IAEA or from Fusion Power Associates.

ENERGY COMPLACENCY

The United States Energy Association, the U. S. member committee of the World Energy Council, has released "The 10th Annual Assessment of United States Energy Policy." Copies may be obtained by calling (202)331-0414 or faxing your request to (202)331-0418. In the report, the association notes that the World Energy Council released a message for 1997 "which pleaded for an end to global energy complacency." They comment, "The American lifestyle, our strong economy and our standard of living would be impossible without continued access to abundant and reasonably priced supplies of energy." They remark, "Both federal government and private-sector research and development budgets continue to decline. Questions go unanswered as to who will pay for long-term globally-oriented development of basic science and deployment of advanced technology. As the energy business world wide moves toward global integration based on market mechanisms, these questions will become more intriguing." The report concludes, "Our consumers, as well as those of other nations, will benefit most from having an opportunity for selecting from a robust mixture of fuels and technology as well as an expanded choice of from whom they purchase energy. As we enter the 21st century, we will likely need to rely on all of the energy and technology resources available including energy efficiency. Policies should strive to allow all resources and all technologies to compete in the market, and let the customer make choices as to which fuel to use and which technology to select."

ANS FUSION ENERGY DIVISION NEWS

The American Nuclear Society Fusion Energy Division (FED) is currently chaired by Bill Hogan (LLNL); vice chair and chair-elect is Wayne Houlberg (ORNL). A list of the Executive Committee members and other information can be found at the FED web site (http://www-ferp.ucsd.edu/ANS). The division organizes a biennial Topical Meeting on the Technology of Fusion Energy. The next Topical will be held June 7-11, 1998 in Nashville, TN. The division also prepares a public policy statement on fusion which is approved and distributed by the ANS. The latest version of the policy statement is available on the above web page. The chairman of the FED is an ex-officio member of the DOE's Fusion Energy Sciences Advisory Committee.

BUDGET UPDATE

Appropriations Subcommittees in the House and Senate have approved budget levels for both the DOE civilian Office of Fusion Energy Research and the DOE Defense Program's inertial confinement fusion program at or slightly above President Clinton's request level (see our March 1997 newsletter), although Congress will likely insist on annual appropriations for the National Ignition Facility (NIF) rather than the multi-year funding authorization requested by the President. Funding for continued U. S. participation in the ITER engineering design activities at the current $55 million level seems assured for FY 1998. The Senate appropriations subcommittee voted to provide $240 million to the DOE Office of Fusion Energy Sciences, which is $15 million more than the President's request; the House appropriations subcommittee voted $225 million. The separate House and Senate actions must still be confirmed by their parent bodies and reconciled before being sent to the President for signature.

MILT JOHNSON LEAVES DOE FUSION POST

Dr. Milton Johnson, deputy associate director , of DOE's Office of Fusion Energy Sciences, is leaving his post to become associate director for laboratory operations and environment, safety and health, of DOE's Office of Energy Research. Johnson was previously manager of the department's Princeton (NJ) Area Office, where he supervised activities at the Princeton Plasma Physics Laboratory.

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EXECUTIVE NEWSLETTER

FUSION POWER ASSOCIATES
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FPA AWARDS ANNOUNCED
LEADERSHIP: DAVID E. BALDWIN
DISTINGUISHED CAREER: MARSHALL N. ROSENBLUTH
ENGINEERING EXCELLENCE: PIETRO BARABASCHI

NEW AFFILIATE

Inco Alloys International, Inc., Huntington, WV, has become an Affiliate of Fusion Power Associates. Dr. Michael G. Fahrmann, Advanced Metallurgist, will represent the company. Inco is a major participant in the ITER project, for which they have developed, in cooperation with MIT, a superalloy material (INCOLOY 908) which will be used on all the ITER superconducting magnets. The material is being used in the U. S., Russia, Europe and Japan. Inco is the sole supplier of this material in the world. Dr. Fahrmann can be reached at Inco Alloys International, Inc., 3200 Riverside Drive, Huntington, WV 25705; (304)526-5084; fax -5973; incotech@access.eve.net. We welcome their participation in Fusion Power Associates.

FPA 1997 AWARDS

David E. Baldwin has been selected as the recipient of Fusion Power Associates 1997 Leadership Award. Dave is VP and leader of the fusion program at General Atomics. Previously he was leader of the Magnetic Fusion Energy Program at the Lawrence Livermore National Laboratory. His award certificate states, "Your wisdom has provided the U. S. and the world fusion efforts with the insightful guidance of a true statesman." FPA Leadership Awards have been given annually since 1980 to individuals "who have shown outstanding leadership in accelerating the development of fusion."

Marshall N. Rosenbluth has been selected as the recipient of Fusion Power Associates 1997 Distinguished Career Award. Marshall is Professor of Physics at the University of California at San Diego. A pioneer of the U. S. fusion program, his contributions to fusion and plasma physics are legendary.

David E. Baldwin

Pietro Barabaschi

Recently, he was selected by President Clinton to receive the National Medal of Science. FPA Distinguished Career Awards have been given annually since 1987 to recognize distinguished, lifelong career contributions to fusion.

Pietro Barabaschi has been selected as the recipient of Fusion Power Associates 1997 Excellence in Fusion Engineering Award. Pietro is currently on assignment from the European Commission to the ITER Joint Central Team in San Diego, where he is Group Leader in Systems Analysis. He is widely praised by his colleagues for the outstanding contributions he has made to the JET and ITER projects. FPA Excellence in Fusion Engineering Awards were established in 1987 in memory of MIT professor David J. Rose and have been given annually since that time. Their purpose is to recognize individuals relatively early in their careers who have made outstanding technical contributions and shown leadership potential in the field of fusion engineering.

SCIENCE MAGAZINE SNIPES AT NIF

In the words of former President Ronald Reagan, "There he goes again!" *Science* writer James Glanz, aided by flamboyant headline writers at *Science* magazine, paints an unfairly gloomy picture of the prospects for successful construction and operation of the National Ignition Facility (NIF) in the 18 July issue. Glanz and *Science* did a similar favor for the International Thermonuclear Experimental Reactor (ITER) in the 6 December 1996 issue (see our January 1997 newsletter).

Glanz says there is "a Cold War-like clash among scientists, ex-bombmakers, government officials, laboratory managers, and even environmental groups . . . debating both whether the laser can live up to its technical goals and whether—even if it does —the tiny bursts of fusion it triggers will have anything to say about aging bombs . . . ." Glanz implies that most knowledgeable scientists place the prospects for success in NIF at "only a little better than 50-50," with "other physicists (putting) the chances at less than 10%." In fact, nothing could be further from the truth. A National Academy of Sciences committee that reviewed NIF in depth for more than a year concluded that "the NIF would make important contributions toward the stated long-term goal of the SBSS (Science-Based Stockpile Stewardship) program," and that "the science and technology have progressed sufficiently to allow the NIF project to proceed as planned." The panel said "The achievement of ignition appears likely, but not guaranteed. The steady scientific and technological progress in ICF (Inertial Confinement Fusion) during the 6 years since the last National Research Council review, the plausibility of ignition estimates based on the experimental and modeling results and capabilities in hand, and the flexibility of the facility all support the committee's finding that the NIF is technologically and scientifically ready to proceed as planned with reasonable confidence in the attainment of its objectives."

Glanz does not mention the Academy review. Glanz also makes the optics sound near to impossible: "NIF will require, for example, more than 3000 slabs of neodymium-doped phosphate glass, each 40 by 80 centimeters in size, to turn bursts from flash lamps into coherent laser light. Add to that a huge number of lenses, mirrors, and the fragile crystals that triple the frequency of the light generated in the amplifiers, converting it from infrared to ultraviolet. Yet another set of optical components will be needed to smooth out the inevitable beam irregularities or hot spots—cousins of the apparent spikes and rings in telescopic images of stars." "These components will need to be free of the kinds of flaws that could make them vulnerable to damage as the enormous pulses of light flow through them." Glanz fails to mention that a prototype beam line of NIF has been operating successfully at Livermore for a couple of years.

On one thing we and the editors might agree: the editors and writers for *Science* could never successfully develop, construct and operate the NIF (or ITER).

NIF TARGET CHAMBER CONTRACT LET

The Engineered Construction Division of Pitt Des Moines, Inc. (PDM), teamed with Precision Components Corporation (PCC), has been awarded the contract to fabricate and erect the Target Chamber for the National Ignition Facility (NIF). The Target Chamber is a 30-foot, 4-inch thick aluminum sphere. PDM will provide the initial engineering effort and will work on the construction site, including field fabrication, at the Lawrence Livermore National Laboratory. PCC is responsible for material procurement, shop fabrication, and machining of the sphere plates. On site construction is scheduled to be completed by September 2000.

In the past, PCC, located in York, PA, has seen much success in manufacture of apparatus for major national accelerator facilities at Brookhaven and Newport News, and has performed work for the Tokamak Fusion Test Reactor facility at Princeton. PDM, with work to be performed at both their Houston and Pittsburgh facilities, has performed many previous tasks for the fusion program, including projects at Livermore, Los Alamos, and Oak Ridge. They currently hold a contract for design and manufacture of the vacuum chamber mock-ups for the International Thermonuclear Experimental Reactor (ITER). For further information, contact Bill DeFelice (bdefelice@pcc-york.com).

ITER COUNCIL MEETS

The ITER Council (IC), the high level committee of government officials from Europe, Japan, Russia and the US that manages the ITER program, met in Finland July 24. Their meeting was preceded on July 23 by a meeting of the ITER Explorers, a group of government officials doing preparatory work for future planning. Both the ITER Director, Robert Aymar, and the Explorers favor a three year extension (from 6 to 9 years) of the present ITER agreement. The Council "supported conclusions and summary proposals presented in the paper and commended them to the Parties for their consideration." The Council asked its Chairman, E. P. Velikhov, to write a letter to the Director-General of the IAEA "inquiring whether the IAEA would be willing to continue to provide the same level of auspices should the Agreement be extended."

EUROPEAN COMMISSION BACKS FUSION

The European Commission has put forth its "5th Framework Programme (1998-2002)" proposals to the European Parliament for funding the next 5 year period. Included in the proposals are the following statements on fusion:

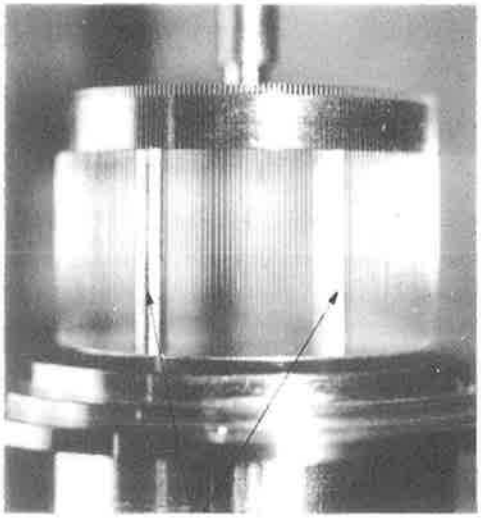
"The long-term objective of this action, embracing all the research activities undertaken in the Member States and Switzerland aimed at harnessing fusion, is the joint creation of a prototype reactor for power stations to meet the needs of society: operational safety, environmental compatibility, economic viability.

"The proposed strategy to achieve this long-term objective includes the development of an experimental reactor (The Next Step) and then of a demonstration reactor (DEMO). Progress to date suggests the construction of the Next Step during the next decade is both technically feasible and strategically necessary. This should preferably take place within the framework of the ITER (International Thermonuclear Experimental Reactor) international cooperation project."

ITER HONORS BOEING TEAM

In a ceremony in St. Louis, U.S. ITER Home Team Leader Charles Baker presented an Outstanding Performance Award to the Boeing (formerly McDonnell Douglas) Company team working on the International Thermonuclear Experimental Reactor (ITER) project. The team has been making contributions to the design and R&D for the ITER divertor and plasma facing components subsystems. Innovations provided by the team have resulted in reducing both the cost and risk associated with the ITER components. Baker cited the team for "outstanding design, R&D and fabrication efforts in overcoming many first of a kind complexities and challenges on the international integration and manufacture of the full scale ITER Divertor System Cassette." Members of the team include John Davis, Dan Driemeyer, Fred Cole, Ted Hellwig, Joe Lodato, Jim Naeger and Kevin Slattery.

Dr. Allen Atkins, Vice President for Product Applications Technologies, accepted the award on behalf of the Boeing Company. He said that ITER "is a terrific example of how aerospace has acted, and continues to act, as a seedbed of important technologies for all of industry." He recognized other members of the Boeing team, including General Atomics, Boeing/Rockwell, Westinghouse, Brush Wellman and the University of Illinois. He also noted that they have been assisted by 42 other lower tier suppliers, including disadvantaged businesses.



Cylindrical Wire Array

SANDIA UPS X-RAY RECORD AGAIN

Scientists in the Pulsed Power Program at Sandia National Laboratories, Albuquerque, who last year (see our June 1996 newsletter) set a world record of producing 85 terawatts and 500 kilojoules of x-rays and this year upped that record to 200 terawatts, 1.9 Megajoules (see our June 1997 newsletter), recently announced that they have successfully applied the technique to produce a 130 eV black body radiation temperature in a vacuum hohlraum. Such hohlraums (cylindrical cases) are used to provide a uniform source of energy to drive implosions of small capsules of deuterium-tritium fuel to fusion temperatures and densities. A radiation temperature of about 2-3 times that obtained on the Sandia facility is believed necessary to ignite such a fusion capsule in the laboratory.

The results are obtained by switching large amounts of stored electrical energy into a cylindrical array of fine tungsten wires, resulting in a burst of x-rays lasting several nanoseconds. In these latest experiments, the wire array is placed inside a vacuum hohlraum coated with 25 microns of gold. The size of the cylindrical hohlraum was 1 cm length and 2.5 cm diameter; the size of the 300-wire array in the hohlraum was 1 cm length and 2 cm diameter.

The results pave the way for accelerated testing of radiation effects of materials, weapons effects simulations and study of the physics of inertial confinement fusion. Sandia has begun the conceptualization of a larger facility, dubbed the X-1, that could be capable of reaching the hohlraum radiation temperatures necessary for producing high gain in small fusion capsules in the laboratory. For further information, contact Jeff Quintenz (jpquint@sandia.gov).

FUSION POWER ASSOCIATES AWARDS

LEADERSHIP

Leadership Awards are presented by the Fusion Power Associates Board of Directors to those individuals who have shown outstanding leadership qualities in accelerating the development of fusion.

1980	S. J. Buchsbaum R. L. Hirsch M. McCormack P. Tsongas
1981	E. E. Kintner
1982	H. P. Furth J. H. Nuckolls
1983	J. L. Emmett T. K. Fowler
1984	T. Ohkawa G. Yonas
1985	E. P. Velikhov C. Yamanaka
1986	R. C. Davidson
1987	M. N. Rosenbluth
1988	J. F. Clarke
1989	P-H. Rebut
1990	B. B. Kadomtsev
1991	B. Coppi E. Storm
1992	R. W. Conn G. L. Kulcinski
1993	D. L. Cook J. Sheffield
1994	C. A. Baker S. E. Koonin
1995	E. M. Campbell D. O. Overskei
1996	M. Abdou R. L. McCrory
1997	D. E. Baldwin

DISTINGUISHED CAREER

Distingished Career Awards are presented to those individuals who have made distinguished lifelong career contributions to fusion development.

1987	M. B. Gottlieb D. Kerst R. F. Post L. Spitzer, Jr.	1992	R. Bickerton A. Bishop V. Glukhikh S. Mori
1988	K. Husimi D. Palumbo R. S. Pease	1993	R. A. Gross M. W. Rosenthal
1989	F. H. Coensgen D. J. Grove F. L. Ribe	1994	C. A. Flanagan W. G. Kunkel
1990	N. G. Basov T. Sekiguchi	1995	T. K. Fowler H. P. Furth
1991	H. K. Forsen J. W. Landis R. L. Sproull H. G. Stever	1996	J. G. Gavin J. H. Nuckolls
		1997	M. N. Rosenbluth

EXCELLENCE IN ENGINEERING

1987	S. J. Piet	1994	C. E. Kessel K. A. McCarthy
1988	M. A. Ulrichson	1995	F. Najmabadi
1989	D. Ehst Y-K. M. Peng	1996	G. G. Denisov P. J. Gierszewski
1990	W. Reierson	1997	P. Barabaschi
1991	J. Santarius		
1992	O. Filatov S. Zinkle		
1993	J. D. Galambos S. W. Haney		

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EUROPE SETS NEW FUSION RECORDS

JET SETS NEW RECORDS

Scientists at the Joint European Torus (JET) facility in the United Kingdom have begun a series of experiments using deuterium-tritium fuel mixtures and, almost immediately, they set three new world fusion records: the most fusion power, the most fusion energy and the highest ratio of fusion energy to input heating energy ever achieved. The experimental runs will last for several weeks. Jet director Martin Keilhacker said, "We hope to improve this somewhat over the next weeks."

The recent JET experiments, using a 50-50 deuterium-tritium fuel mixture, yielded more than 12 million watts of fusion power, 11 million joules of fusion energy and a ratio of fusion energy to input heating energy of 50 percent. The previous records, held by the Tokamak Fusion Test Reactor in the U. S., were 10.7 Megawatts, 7.6 Megajoules and 28%, respectively.

The present series are the first deuterium-tritium experiments in JET since 1991, when a 10% mixture was used for a short time. The recent runs upped the fusion power in JET by a factor of 6, compared to the 1991 experiments. Since 1991, the JET facility has been upgraded to include a divertor to handle higher levels of exhaust power. Over the next few years, JET will be devoted to verifying various aspects of the physics models being used to design the International Thermonuclear Experimental Reactor (ITER).

Since the termination of the U. S. Tokamak Fusion Test Reactor this year by order of Congress, JET and the JT-60U in Japan are the flagships of the world fusion effort. An integrated workforce of about 700 from many European countries, and many visiting scientists from around the world, operate JET.

For further information, contact Tom Elsworth (telsw@jet.uk) or visit the JET web site (http://www.jet.uk).

U. S. BUDGET AND STRATEGY

Conferees of the House and Senate of the U. S. Congress, meeting on September 25, agreed to appropriations for the Department of Energy for Fiscal Year 1998, which began on October 1. The agreement reached includes appropriations for the DOE's Office of Fusion Energy Sciences and for the inertial confinement fusion program within the DOE Defense Programs office. It was good news.

The Office of Fusion Energy Sciences (OFES) will receive $232 million, which is $7 million more than requested in the President's budget. Two million of that, however, is an accounting transfer for a materials program that was previously in the nuclear energy programs budget. Nevertheless, the action marked a sharp reversal of the downward trend of the past two years. The inertial confinement fusion (ICF) program will receive the amounts requested by the President for both the base ICF program ($217 million) and for the next year of construction of the National Ignition Facility ($197.8 million). Although the conference report must still be adopted by the full House and Senate and signed by the President, this is expected to be pro-forma and rapid.

Meanwhile, a subpanel of the DOE Fusion Energy Sciences Advisory Committee (FESAC) has been meeting for the purpose of making recommendations on fusion strategy relative to the next phase of ITER (the International Thermonuclear Experimental Reactor project). The present agreement on ITER ends next July. The full FESAC will take up the committee's recommendations at a public meeting October 20-21 in the DOE auditorium in Germantown, MD. Persons can make 5-minute statements at the meeting by signing up with John Galambos (galambosjd@ornl.gov). Email statements may also be sent to Galambos for transmittal to the FESAC.

One group of fusion researchers have already prepared and submitted to the subpanel a detailed proposal saying, "Our assessment, shared by many of our colleagues, is that the U. S. strategy to explore the science and technology of energy-producing plasmas must change in the post-ITER-EDA period." The proposal, entitled "A US Strategy to Explore the Science and Technology of Energy-Producing Plasmas, Discussion Draft, September 16, 1997," is available on the web (http://www.fusionscience.org/policy/). Signers of the proposal are David Baldwin (GA), Robert Goldston (PPPL), Michael Mauel (Columbia U.), Miklos Porkolab (MIT), Michael Saltmarsh (ORNL) and Keith Thomassen (LLNL).

GOLDSTON ANNOUNCES PPPL ORGANIZATION

Princeton Plasma Physics Laboratory Director Rob Goldston has announced a reorganization of the Laboratory. The Director's Office will consist of Rob, Richard Hawryluk as Deputy Director and Bill Tang as Chief Scientist. Rob indicates that he will entrust to Rich the "major responsibility for internal operations at the Laboratory." Bill Tang will be responsible for assuring that the "ongoing scientific program is addressing the key issues as they develop and that exciting research opportunities are not overlooked." Bill will also "have major responsibility for representing the Laboratory, and for coordinating representation of the Laboratory, in the scientific community." The Director will also be assisted by a Research Council and a Director's Cabinet. In addition to the members of the Director's Office, Princeton University Professor Will Happer will serve as a member of the Director's Cabinet. The Director's Cabinet will deal with "key policy issues."

The activities of the Laboratory will be carried out in eight major Departments: Advanced Projects (John Schmidt, Head; Hutch Neilson, Deputy), Off-Site Research (Ned Sauthoff, Head), Plasma Science and Technology (Stuart Zweben, Head), Theory (Bill Tang, Head; Steve Jardin, Deputy), Experiment (Joel Hosea, Head), Engineering and Technical Infrastructure (Mike Williams, Head), Business Operations (Ed Winkler, Head), and Environment, Safety and Infrastructure Support (J. W. Anderson, Head) The Director's Office will also be supported by an Associate Director for External Affairs, John DeLooper, and a Human Resources Office, headed by Steve Iverson.

Rob expressed thanks and appreciation to departing Deputy Director Dale Meade. Dale will continue at the Laboratory, where he will be looking into possibilities for an experiment to succeed TFTR and into other applications for fusion neutrons. Rob also announced the early retirement of Rush Holt, who ran for Congress last year. Rush departed the Laboratory October 1.

JUDGE REJECTS HALT TO NIF

In an August 8 opinion, U. S. District Judge Stanley Sporkin denied a request, filed by 39 activist groups opposed to DOE's Stockpile Stewardship program, for a preliminary injunction to block construction of the National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory. Sporkin said he doubted whether the plaintiffs, led by the Natural Resources Defense Council, will succeed on the merits of the case, but he did instruct DOE to provide more information on why it dismissed an approach to Stockpile Stewardship that would place more emphasis on remanufacturing of aging weapons.

In rejecting the groups request, which was based largely on the claim that the DOE's Program Environmental Impact Statement (PEIS) was incomplete, the judge said, "Indeed, if the court were to order that a PEIS be done with the comprehensiveness that plaintiffs request, it is very doubtful that any such document could be completed quickly and thoroughly enough to aid decision makers and the public before the politics and the technology changed. The only effect would be to strangle the (stockpile stewardship management) program in its cradle." Sporkin also noted that the DOE and its predecessor agencies had been managing the stockpile for more than 50 years and hence the stockpile stewardship management program was not really "new." This fact bore on his decision not to require a more comprehensive assessment.

The judge indicated that he was inclined to provide "some deference" to DOE in determining what programs were required to maintain the U. S. nuclear deterrent. Sporkin said, "This is an age when rogue nations and worldwide terrorist organizations may soon be able to gain access to nuclear weapons and attempt to use them to achieve nefarious goals. A nation with our responsibility for world leadership must be able to act quickly and effectively against all such threats."

For their part, the plaintiffs said they regretted the judge's decision but were "pleased that he recognized the legitimacy of the plaintiff's concerns about the environmental, health and safety risks" of the program. They said they would "continue to oppose the wasteful, provocative and environmentally dangerous" stockpile stewardship management program. In addition to NIF construction, the groups had also sought to block construction of two facilities for the production of plutonium pits at Los Alamos National Laboratory in New Mexico. Judge Sporkin said that he expected the DOE to meet the group's "reasonable requests" for more information within 60 days.

JAPAN UPDATE

In late April, press reports in Japan alerted the world that discussions were underway in government circles on how to deal with the Japanese government's budget deficit and that this could lead to a moratorium on new large construction projects, including ITER. Since that time, such a moratorium has been officially adopted. Speaking to a meeting of the American Association for the Advancement of Science on July 8, the Honorable Koji Omi, a member of the Japanese House of Representatives said, "In recent years, there has been much international discussion about the International Thermonuclear Experimental Reactor (so-called ITER) project. It is a project in which Japan has significant interest. Unfortunately, as I stated previously, Japan is facing a very difficult financial situation, and the next 3 years will be a period of intensive budgetary reform. As a result, the Government has decided not to begin any new large-scale projects, including building the ITER in Japan, during this period."

Omi went on to say, "However, please do not misunderstand the meaning of this decision. It does not mean that we will give up on the project forever. Those Japanese individuals involved in the ITER project hope to introduce this as a new project as soon as the 3-year period of budgetary reform is over." Omi said that "Japan is putting a priority on steadily carrying out international large-scale projects." He said, "It is important for the Japanese Government to focus its spending on areas that will provide a foundation for future economic growth." He commented, "We recognize that, as a world leader, Japan should cultivate new knowledge with which we can help solve global problems, including those related to the environment and food and energy shortages. As we look toward the 21st Century, we realize that all nations need to work together to solve such problems in order to create a more peaceful and prosperous world. And, in fact, Japan intends to work to make a substantial contribution to resolve these pressing issues."

FIFTY TWO COMPANIES URGE PEÑA TO SUPPORT ITER

The representatives of 52 U. S. companies wrote a letter, dated September 18, to Energy Secretary Federico Pena, urging him "to commit to continued meaningful participation in the International Thermonuclear Experimental Reactor (ITER) project, and to provide a funding level which enables U. S. industry to participate in the ITER transition period." They said, "There is important work that remains to be accomplished in preparing for ITER's construction and U. S. industry needs to be involved." The group noted, "ITER is the only project on the drawing board that can provide U. S. industry with the opportunity to participate in developing the technology of fusion energy. Further, it also places us in a position to capitalize on commercializing fusion's spin off technologies." They commented, "It is industry that will build ITER and future commercial fusion energy systems. We have the capability and the desire to make ITER successful. If the U. S. withdraws from ITER, our companies will be at a disadvantage in the global marketplace -- relegating the U. S. to be an importer of fusion technology, and its spin off technologies as well. The United States taxpayers have invested a substantial amount to establish fusion's scientific foundation. U. S. taxpayers deserve to see a return on their investment by establishing a U. S. industry capability to supply fusion energy systems."

Companies signing the letter were: Advanced Alloys, Arc Applications, Arcos Alloys, Arrowhead Tool, Bechtel, BIW Cable Systems, Bodycote IMT, Boeing, Brush Wellman, Chicago Bridge and Iron, Climax Research Services, Coleman Research, Composite Technology Development, Council on Superconductivity for American Competitiveness, Cryogenic Materials, Daedalus Research, Diamond Ground Products, DTX, Energy Analysis & Systems, Everson Electric, Fusion Power Associates, General Atomics, George A. Mitchell, Helicoflex, Intermagnetics General, Inco Alloys International, Kemco Tool & Machine, Lockheed Martin, Martinez & Turek, Meyer Tool & Mfg., New England Electric Wire, Northrop Grumman, Osram Sylvania Products, Paulo Products, PaR Systems, PDM Engineered Construction/Pitt DesMoines, Plasma Processes, Precision Calibration & Testing, Precision Components, Pyramid Manufacturing, Raytheon Engineers and Constructors, Rocky Mountain Composites, Sciaky, SAIC, Stone & Webster Engineering, TRW, Teledyne Wah Chang, Variation Systems Analysis, Vortex, Wall Colmonoy, and Westinghouse Electric Corporation.

IN MEMORIAM: O. B. MORGAN

Former director of the Oak Ridge National Laboratory fusion program, O. B. (Bill) Morgan died September 4 at his home in Oak Ridge, TN. In 1996 he was disabled by amyotrophic lateral sclerosis, known in the U. S. as "Lou Gehrig's disease." Bill was a beloved figure of the U. S. fusion program, combining personal warmth and outstanding technical accomplishment. His death at the age of 67 is a great loss to his family and friends.

Bill joined Oak Ridge National Laboratory in 1958 and retired in 1994, having risen to the position of Associate Director of the Laboratory. He attended North Carolina State University and received his Ph.D. in nuclear engineering from the University of Wisconsin. He was a pioneering researcher in the field of intense ion beams for heating fusion plasmas. He received a Distinguished Service Citation in 1987 from the

University of Wisconsin for his career accomplishments and was elected Fellow of the American Physical Society. His hobbies included boating and jogging.

He is survived by his wife, Nancy McCracken Morgan, an artist and longtime teacher in the Oak Ridge schools; two sons and their wives, and a sister. A memorial service was held September 7, 1997 at First United Methodist Church in Oak Ridge. Mrs. Morgan can be contacted at 126 Westlook Circle, Oak Ridge, TN 37830.

The family requests that any memorials be in the form of donations to First Methodist Church, P. O. Box 4669, Oak Ridge, TN 37831-4669, or to Muscular Dystrophy Association, Attn: Lee Willard, 4611-A Central Avenue Pike, Knoxville, TN 37912.

FICKLE FISCAL FACTOID

Two years ago the U. S. Congress slashed fusion funding by over $100 million as part of a set of draconian actions aimed at eliminating the federal deficit by 2003. Now, according to the Wall Street Journal (September 3, 1997) the Congressional Budget Office is projecting a $32 billion surplus by the year 2002. The new projections are based, in part, on a "brighter economic outlook" that is expected to result in increased federal revenues. The new projections predict that the federal budget will then "remain in the black at least until 2007, when an $86 billion surplus is projected." Just last January the same Congressional Budget Office was projecting a $188 billion deficit in 2002, according to the Journal.

WATKINS URGES MORE ATTENTION TO INTERNATIONAL SCIENCE PROJECTS

Former Energy Secretary (1989 - 1993) James D. Watkins, writing in the August 1, 1997 issue of Science, says that "Overall, U. S. international relations have suffered from the absence of a long-term, balanced strategy for issues at the intersection of science and technology with foreign affairs." He says, "Sometimes this absence of analysis and policy leads to unpreparedness for major issues, bitter interagency disputes, and inadequate last-minute preparations for an international meeting." Watkins says, "I found that there was seldom any acceptance of the relevance or urgency of S&T (science and technology) to foreign affairs at the level of secretary of state or assistant secretary of state." He comments, "It is clear that unless the White House and State Department giants become integrally involved from the outset, and unless these (S&T) initiatives appear at appropriate times on either head-of-state or foreign minister agendas for meetings with their U. S. counterparts, large collaborative international S&T initiatives are doomed to failure."

Watkins specifically cites the International Thermonuclear Experimental Reactor (ITER) project. He says, "A similar dilemma will soon face ITER as the preliminary engineering design phase winds down and a start is made toward constructing a fusion power demonstration machine. Whenever real money needs to be committed by the United States to start building such a device, our recent track record indicates that we will fold (often without notice to other partner nations). By 'real,' I mean money outlays that often must ramp up quickly to three or four times what prior project costs were in the early research and development phases. DOE continues to manage ITER as best it can, left alone in this case to work with the many international partners from Asia and Europe. But, like the SSC (Superconducting Super Collider) ITER was never a serious concern of our White House or State Department during my tenure. Their neglect was all the more puzzling given the clear potential for both ITER and the SSC to loom large on the foreign affairs agenda in a few years. State Department involvement, understanding, and support today can offer the best hope of funding success tomorrow, but leadership there always seems to be lacking in both timely enthusiasm and technical qualifications. ITER will probably suffer the same fate as the SSC."

Watkins, who for the past four years has been president of the Consortium for Oceanographic Research and Education, in Washington, DC, said that "The United States cannot afford to perpetuate its lack of connectivity between scientific research and foreign affairs. Exciting research outcomes, accentuated in both number and quality by the explosion in new scientific tools and discoveries, are presenting opportunities which are too often lost because of this long-standing disconnect." Watkins noted that in 1992, the prestigious Carnegie Commission had pointed out that "Revolutionary advances in physics have led to diverse applications in weapons, energy, materials, and medicine, with extraordinary impacts on the quality of life and on economic and political relationships among countries . . . ." Examples given by the Carnegie Commission of "scientific and technological trends (that) shape global competition and cooperation" included "greenhouse gases, the AIDS virus, agricultural biotechnology, advanced energy systems, new pharmaceuticals, and information technologies."

QUOTABLE

"Let no man say it cannot be done. It must be done and we have undertaken to do it."

Franklin Delano Roosevelt, 1942

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CLINTON ADVISORS URGE ENHANCED ENERGY EFFORT
U.S. TO SEEK CHEAPER ITER

NEW AFFILIATE

Plasma Processes, Inc., 4914 D Moores Hill Rd., Huntsville, AL, 35811, has joined Fusion Power Associates as a Small Business Affiliate. Timothy McKechnie, Director, will represent the company. He can be reached at (205)851-7653; fax: (205)859-4134; email: McKechnieT@aol.com. The company, established in 1992, specializes in thermal spray coatings, high efficiency thermal spray nozzles, and metallurgical support services. Their techniques were originally developed for the space shuttle and support a wide range of industrial applications. We welcome their participation in Fusion Power Associates.

PCAST URGES ENERGY EFFORT

The Energy Research and Development Panel (see our March 1997 newsletter) of the President's Committee of Advisors on Science and Technology (PCAST) has issued an executive summary of its report, "Federal Energy Research and Development for the Challenges of the Twenty-First Century," dated September 30, 1997. The report, which has been transmitted to President Clinton by the PCAST, is expected to be used by the President in preparing for a Summit meeting on Global Climate Change in December and for setting spending priorities during the FY 1999 budget process. The panel was chaired by John Holdren, Harvard University; the Nuclear subpanel was chaired by John Ahearne, Duke University. The PCAST is co-chaired by John Young and the President's Science Advisor, Jack Gibbons.

The PCAST recommended across the board increases for most energy R&D programs, including fusion, over the next five years. The panel said these increases were necessary "to close the gap between the current energy R&D program and the one that the challenges require."

For fusion, the panel recommended gradual increases from the present $232 million level to a level of $328 million in 2003. They said, "Our Panel reaffirms support also for the specific elements of the 1995 PCAST recommendation that the program's budget-constrained strategy be around three key principles: (1) a strong domestic core program in plasma science and fusion technology; (2) a collaboratively funded international fusion experiment focused on the key next-step scientific issue of ignition and moderately sustained burn; and (3) participation in an international program to develop practical low activation materials for fusion energy systems."

They said, "The U.S. program should establish significant collaborations with both the JET program in Europe and the JT-60 program in Japan. Such collaboration should provide experience in experiments that are prototypes for a burning plasma machine, such as ITER, and that can explore driven burning plasma discharges."

Regarding the future of the collaboration on ITER, they said, "The Panel judges that the proposed 3-year transition between completion of the EDA and an international decision to construct is reasonable and that the ITER merits continued U.S. involvement. It would be helpful to all parties in the ITER enterprise if at least one of the parties would express, within the next year or two, its intention to offer a specific site for ITER construction by the end of the 3-year period."

They said, "Clearly, one major hurdle to ITER construction is its total project cost, most recently estimated to be $11.4 billion, with the host party expected to fund a substantial share. If the parties agree to move forward to construction, the U.S. should be prepared to determine, with stakeholder input, what the level and nature of its involvement should be. The PCAST Energy R&D Panel believes that if no party offers to host ITER in the

next three years, it will nonetheless be vital to continue without delay the international pursuit of fusion energy. A more modestly scaled and priced device aimed at a mutually agreed upon set of scientific objectives focused on the key next-step issue of burning plasma physics may make it easier for all parties to come to agreement."

They said, "The present funding level of $230 million is too low in the view of the PCAST Energy R&D Panel; it allows no significant U.S. activity relating to participation in an international program to develop practical low-activation materials; reduces the level of funding for design of the International Thermonuclear Experimental Reactor (ITER); forced an early shutdown for the largest U.S. fusion experiment; and canceled the next major U.S. plasma science and fusion experiment. It also limited resources available to explore alternative fusion concepts."

The Panel reviewed five "applied energy-technology R&D" areas: end-use efficiency, fission, fusion, renewables and fossil. They recommended that the efficiency budget be increased by $507 million to a total of $880 million; the fission budget be increased by $77 million to a total of $119 million; the fusion budget be increased by $96 million to a total of $328 million; the renewable budget be increased by $382 million to a total of $652 million; and the fossil budget be increased by $68 million to a total of $433 million; all by the year 2003.

In transmitting the report to the President, PCAST co-chair John Young said, "PCAST endorses the report's findings that this country's economic prosperity, environmental quality, national security, and world leadership in science and technology all require improving our energy technologies, and that an enhanced national R&D effort is needed to provide these improvements. The inadequacy of current energy R&D is especially acute in relation to the challenge of responding responsibly and cost-effectively to the risk of global climatic change from society's greenhouse gas emissions, in particular, carbon dioxide from combustion of fossil fuels.

"We recommend focusing the government's energy R&D on projects where high potential payoffs for society as a whole justify bigger R&D investments than industry would be likely to make on the basis of expected private returns and where modest government investments can effectively complement, leverage, or catalyze work in the private sector."

The report recommends an increase, over a five-year period, of $1 billion in the Department of Energy's annual budget for applied energy-technology R&D. The largest shares of such an increase would go to R&D in energy efficiency and renewable energy technologies, but nuclear fusion and fission would also receive increases. The composition of the R&D supported on advanced fossil fuel technologies would change in favor of longer-term opportunities, including fuel cells and carbon-sequestration technologies, but the overall spending level for fossil-fuel technologies would stay roughly constant in real terms.

The proposed total for FY 2003 would return the DOE's real level of effort in applied energy-technology R&D in that year to about where it was in FY 1991 and FY 1992. In constant dollars, the average real growth rate would be 8.3 percent per year.

The PCAST told the President, "We respectfully urge, further, that you increase your efforts to communicate clearly to the public the importance of energy and energy R&D to the nation's future, and we recommend that you clearly designate the Secretary of Energy as the national leader and coordinator for developing and carrying out the national energy strategy." They said, "PCAST hopes that these recommendations will be helpful to you as you consider how the United States can best face major energy related challenges as it enters the 21st century. Of particular importance, prudence requires having in place an adequate energy R&D effort designed to expand the array of technological options to enable significant reductions in greenhouse gases at the lowest possible economic, environmental, and social cost. The energy R&D portfolio we propose will be of crucial importance in meeting that challenge. Many of the energy-technologies that will help with the problem of climate change, moreover, will also help address other energy-related challenges, including reducing dependence on imported oil, diversifying the U.S. domestic fuel- and electricity-supply systems, expanding U.S. exports of energy technologies, reducing air and water pollution,and reducing the cost, safety and security risks of nuclear energy systems around the world."

FESAC URGES SEARCH FOR CHEAPER ITER

A Panel of the US DOE Fusion Energy Sciences Advisory Committee (FESAC), charged with preparing recommendations on U.S. participation in the next phases of the ITER (International Thermonuclear Experimental Reactor) project, presented its report to the FESAC on October 20. FESAC then presented its recommendations to the DOE on October 23.

The Panel was chaired by Hermann Grunder of the Thomas Jefferson National Accelerator Facility (see our August 1997 newsletter). In their report, the Panel states that "the central near-term goal" of this portion of the program "is the

demonstration of a self-heated, energy producing fusion plasma." In bold letters, the Panel states that its central recommendation is: IN CONCERT WITH OUR INTERNATIONAL PARTNERS, A BURNING PLASMA FACILITY SHOULD BE BUILT AT THE EARLIEST POSSIBLE TIME.

They propose four "elements for a U.S. strategic plan for the next three years" to achieve this objective.

First, "Pursue near-term opportunities for research supporting energy-producing fusion plasma science using existing unique large-scale facilities abroad." They specifically recommend "increased participation in the large foreign experiments, JET and JT-60U, with the objective of establishing advanced tokamak physics in large tokamaks."

Second, "Restructure the fusion energy technology development effort to more broadly support the fusion energy objective of the program." They state that the U.S. "should continue to participate in those aspects of ITER technology R&D which are dual-purpose, in the sense that they are both critical for a variety of approaches to fusion energy and they also help complete the R&D required for the ITER design." They state, "It is important to continue U.S. industry involvement in fusion technology R&D, which at the present time is largely carried out through the ITER EDA (Engineering Design Activities)."

Third, "Continue to participate in and support the ongoing ITER joint design work at a lower level." They say, "Continued involvement gives us the opportunity to participate in the construction and operation of ITER, should the parties decide to go forward with it."

Fourth, "Undertake design efforts on lower cost fusion-energy-producing plasma concepts." They say, "we believe that it is prudent for the international community to examine options that involve reconsideration of the fundamental trade-offs between cost, risk and mission," saying "these options provide a contingency plan that will be necessary in the event that the financial commitments cannot be secured for the full-mission ITER machine."

The Panel said that their recommendations were in the context that, even though ITER is ready to proceed into construction, "construction phase financing is not presently available (and) a construction decision has been delayed, and a 3-year transition period has been proposed." They said, "If a decision to construct ITER were being sought today, the panel would recommend U.S. participation at an appropriate level,"

In a letter dated October 23 to DOE Director of Energy Research Martha Krebs, FESAC chair John Sheffield, of Oak Ridge National Laboratory, told Krebs that "The FESAC endorses the strategic plan of the Grunder Panel and makes comments on it below." Sheffield also noted the recent report of the President's Committee of Advisors on Science and Technology (PCAST). Sheffield told Krebs: "The FESAC would like to emphasize the significance of ITER's impact over the past decade. By working collaboratively, the ITER partners (European Union, Japan, Russia, and the U.S.) have benefited immensely through cost sharing and program focus. It is desirable to continue this process of international collaboration, as the Grunder Panel stated: 'if a decision to construct ITER were being sought today, this Panel would recommend U.S. participation at an appropriate level.' Similarly, PCAST recommended that if 'any of the parties states its intention to offer a site for ITER in the next year or two, the US should be prepared to continue to maximize its participation in ITER.'"

Sheffield also told Krebs: "In response to the charge regarding the criteria for a decision on the level and nature of U.S. participation in the ITER construction, FESAC supports the central recommendation of the Grunder Panel: 'In concert with our international partners, a burning plasma facility should be built at the earliest possible time.' This recommendation should have priority as our vital interest in entering ITER negotiations. In the context of a Fusion Energy Sciences budget totaling $250 million, we believe that an appropriate FY1999 funding level for the activities which are in direct support of the central recommendation is approximately 20% of that total."

Sheffield said, "The FESAC agrees with the Grunder Panel recommendation that the content and balance of the ITER activities should be restructured during the transition phase. The baseline design is well advanced, much of the dedicated R&D in support of it will be completed by the end of the EDA, and site-specific work does not involve a U.S. site. FESAC therefore accepts the Grunder Panel suggestion that U.S. participation in ITER's joint work on the baseline design proceed at a lower level during the transition phase."

Sheffield further wrote, "The FESAC concurs with the Grunder Panel recommendation that the fusion energy technology effort be restructured to support the energy objective of the program more broadly. Much of the U.S. fusion technology effort has been subsumed under ITER during the past five years. It has also largely been of a dual use nature, to meet the needs of ITER and those of the general U.S. fusion program. The FESAC agrees that this dual use aspect should be the focus, and the U.S. industry involvement in fusion technology should continue."

Sheffield continued, "In the spirit of the Grunder Panel's suggestion 'that the US explore with our [international] colleagues the possibility for increased collaboration in JET [and] JT-60U,' FESAC recommends a vigorous experimental program aimed at burning plasma physics issues as well as the physics basis for possible cost reduction through plasma optimization. Such a program should take advantage of domestic devices such as DIII-D and C-Mod and the U.S. fusion theory program, in addition to international experimental collaboration."

Sheffield concluded, "Finally, to act on the central recommendation of the Grunder Panel, and consistent with the PCAST recommendation, FESAC considers it critically important that DOE enter future international negotiations with a high level, long-range commitment to support a 'next step facility aimed at a mutually agreed upon set of scientific objectives,' as stated by PCAST."

BAKER, SALTMARSH TO FORM "VIRTUAL LABORATORY"

DOE Office of Fusion Energy Sciences director N. Anne Davies has announced that she has asked Dr. Charles Baker of the University of California at San Diego to be "director" of a "virtual laboratory" for fusion energy technology. Dr. Michael Saltmarsh, director of the Fusion Energy Division at Oak Ridge National Laboratory, would be the "deputy director" of the virtual laboratory. Davies said the action would provide a "clearly defined technology leader in U.S. fusion community for advocacy, consensus building, and communication." She said the "lab" would provide "coordination of large number of diverse, but interrelated, technology activities at many universities, national laboratories, and industry groups . . . improved outreach and coordination of international collaborations (and) better coordination with and response to physics activities." She said the formation of the virtual laboratory would take shape gradually over the coming year, with full implementation by the end of FY 1998.

16 UNIVERSITY PRESIDENTS SUPPORT FUSION

In an unprecedented show of interest and support for fusion research, the presidents of 16 U.S. universities wrote energy secretary Federico Peña a letter dated October 3 stating, "Fusion energy sciences addresses intellectual challenges of fundamental importance and develops applications with clear societal benefits. Our universities are commiting academic resources to the excellence of research and teaching in this area." They noted "rumors of further funding reductions" in the fusion area and said, "We are concerned that reductions would endanger the intellectual vitality of this area of science and are writing to express our strong support for Fusion Energy Sciences." The universities represented were: Auburn, Columbia, Hampton, MIT, William and Mary, Cornell, Lehigh, NYU, Princeton, Colorado, Maryland, Texas, Wisconsin, and the University of Calilfornia at Irvine, Los Angeles and San Diego.

NSTX COLLABORATION

Opportunities will be provided to collaborate on the National Spherical Torus Experiment (NSTX), a new facility being constructed at the Princeton Plasma Physics Laboratory. For further information, go directly to the web at the following URL: http://fileroom/nstxhome/index.shtml, and then click "NSTX Research Program." Then click "National Process." Then click "Notice of Available Research" to view a presentation describing the scientific topics for enhanced collaboration on NSTX during FY 1999 - 2001. Also, click "Meetings" and the "FY98 Research Forum" to view the announcement inviting collaborating researchers to attend the Forum to learn about the plans for NSTX capabilities and operation, and to contribute to the discussion on the scientific elements of interest to NSTX research. See how easy it is!!

PLASMATRON BREAKTHROUGH

Under the leadership of fusion researcher Dan Cohn at MIT, and with support from the DOE Office of Heavy Vehicle Technologies, a device called a "plasmatron" has been developed that generates a hydrogen-rich gas from biocrude oils. The researchers say that the device, about the size of a soup can, can be introduced into present vehicle technology and, by adding only a small amount of such gas to the fossil fuel powering the car, can result in a significant decrease in emissions of pollutants like nitrogen oxides. Dan Cohn says, "No major advances are needed in internal combustion engine design to incorporate it." The fuel, which may be gasoline, diesel or biocrude oils, is injected into an electric arc that turns a portion of the fuel into plasma. The plasma "accelerates reaction rates allowing the production of hydrogen-rich gas."

Plasmatrons have been used previously to produce hydrogen-rich gas for industrial applications like metallurgical processing, but they are usually quite large. "We're the first to develop a compact, low-power plasmatron," said Dr. Cohn. "To our knowledge no-one has created one that's this small (you can hold it in your hand) and that operates at low power (around one kilowatt)."

For more information, contact Elizabeth Thomson (thomson@mit.edu) or Dan Cohn (cohn@pfsc.mit.edu).

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FUSION POWER ASSOCIATES

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SUPREME COURT, JUSTICE DEPT. REBUFF ACADEMY OF SCIENCES

ACADEMY REBUFFED

The U.S. Supreme Court, without comment on November 3, let stand a lower court's ruling that National Academy of Sciences advisory committees are subject to the 1972 Federal Advisory Committee Act. The suit was first brought against the Department of Health and Human Services and the Academy by the Animal Legal Defense Fund. The courts had also ruled that the report of the DOE's Inertial Confinement Fusion Review Panel could not be used by the Department in setting policy because of the Academy's failure to follow the procedures called for under the law (See our April 1997 newsletter). Despite pressure from DOE, NSF, NASA, and other agencies who supported the Academy, the Justice Department refused to argue on the Academy's behalf, instead urging the Court not to review the case. In their brief, the Justice Department said review would be premature because the law's effect on Academy proceedings was not yet clear. Academy of Sciences executive officer, Dr. E. William Colglazier, said "It is certainly a true crisis for the Academy, probably the most serious one we have ever faced." The law requires that meetings of committees advisory to the Government be open to the public and that a Government official always be present during their deliberations. Academy officials insist that subjecting it to the law would undermine its independence from the Government and the credibility of its reports. In refusing to support the position of the Academy, the Justice Department said it did not agree that the mere presence of a Government employee at committee meetings would compromise independence.

DOE canceled a scheduled Academy review of the International Thermonuclear Experimental Reactor (ITER) project (See our August 1997 newsletter) because lawyers for DOE and the Academy could not agree on procedures for the review.

Although the Academy claims independence of Government influence in its committee deliberations, the Academy receives tens of millions of dollars a year from the Government to conduct the studies and usually does not undertake studies unless they are requested and paid for by the requesting agency. The Academy has now turned its attention to Congress and is lobbying for a revision in the law to exempt them from its provisions. The National Resources Defense Council, which successfully challenged the DOE on the Inertial Confinement Fusion Review, conducted by the Academy, is lobbying the Congress to stand pat. On November 13, they issued a report claiming to "detail how conflicts of interest compromised" the Academy's fusion panel. For further information on that report, contact Lisa Magnino (202)289-2405 (email:lmagnino@nrdc.org).

EUROPEANS, JAPANESE SUPPORT ITER

Martin Keilhacker, director of the Joint European Torus (JET) project, is quoted in the November 5 issue of *Nature*, commenting on the FESAC recommendation (See our November 1997 newsletter) that the U.S. should divert some of its ITER resources to increased collaboration on JET. He says, "There is certainly scope for more US involvement and we already have very good collaboration with US laboratories. But there is the political problem that we in Europe are convinced that the fusion community is ready to build ITER, while the United States—partly for budgetary reasons—is not." The article states, "JET officials say there appear to be no technical obstacles to construction and—in apparent contrast to those responsible for the US fusion programme in Washington—are keen to move quickly to the construction phase with a minimum loss of momentum. In this context they are reacting cautiously to proposals from some senior US fusion physicists that the United States should divert some of the money that might otherwise be dedicated to ITER to support work at JET."

At its meeting of November 10, the Research Council of the European Commission (EU) confirmed that it had received

letters of intent to offer sites for ITER construction from Italy and Canada and they endorsed a 3-year extension of the present ITER agreement.

Also, in a letter dated October 9, Dr. Masaji Yoshikawa, president of the Japan Atomic Energy Research Institute, asked DOE Secretary Federico Peña for "your support towards the full US participation in the ITER EDA, in particular, in the 1999 budget." Yoshikawa said, "The first reason is that 1999 is a very important first year of the extended period of EDA towards the future construction of ITER. Both EU and Japan are in the budgetary process for such full participation and wish to have a US participation at equal level to carry out required technical activities. Secondly, we desperately need full participation of highly capable US scientists and engineers as well as US industry for the effective implementation of ITER EDA in this period."

DEVELOPMENT PATHWAYS EXPLORED

Fusion Power Associates has issued a summary of its August 27-29 symposium, "Pathways to Fusion Power." The symposium covered seven topics.

In the first topic, "What is our view of the future marketplace?" the conference summary notes that the marketplace for electric power in the U.S. is expected to become increasingly competitive in the near- and mid-term and that current conceptual designs of fusion power plants project cost of electricity higher than today's sources and hence could not compete today on economic grounds. It says, "In the long-term, projections are difficult. Factors like global warming or regional availability of fuels favor technologies like fusion." The summary says, "Although the opportunity for fusion to compete commercially is decades into the future, it is not too early for the fusion community to seek closer ties with its future customers. At a minimum, their interest is required for political support. However, their technical experience would also be valuable for guiding our R&D program." It comments that "It is also important to note that market forces vary around the world and, in many other countries, the power industry is more government-controlled than the future projections for the U.S. A favorable trend in the U.S. is the emergence of large nuclear power plant operating companies. These companies may be more receptive to fusion."

The symposium also addressed the topic, "Will fusion enter the marketplace as an Electric Power Producer or as a supplier of some other needed product?" The summary notes that "There are a range of possible commercial and military applications for both fusion itself and for technologies developed for fusion. Some of these might provide early demonstrations of the utility of fusion and/or fusion technologies. It is important to seek out such applications in the near- and mid-term, in view of the economics of the electric power market. Here again, it is important that there be early dialogue with potential customers, for the reasons given above for the electric power market."

A third topic addressed was "Can other fuel cycles compete with the D-T fuel cycle?" On this question, the summary says "Material presented at the symposium indicate that, on a physics basis, it will be difficult for other fuel cycles to compete with the D-T cycle. And, as indicated above, even the D-T cycle will have difficulty competing with other technologies on economic grounds. Nevertheless, advanced fuels may possess engineering, safety and/or environmental advantages and hence merit an active ongoing research effort, emphasizing concepts that might be uniquely matched to such cycles."

Topic 4 concerned the tokamak path to commercial fusion. The summary says "The development of the tokamak science and technology base has been a great success story and will benefit the evolution of any magnetic concept. Improvements in the conventional tokamak as well as more significant departures, such as the Spherical Torus, may well lead to commercial success. ITER represents an opportunity to leverage off the mainstream of the world fusion effort in both fusion science and fusion technology. If ITER proceeds into construction, the U.S. should attempt to be a significant participant."

Topic 5 concerned the inertial confinement pathway to commercial fusion. The summary says, "The inertial fusion community has done outstanding science and technology work in the pursuit of its concepts and has provided a potential path to commercialization. However, additional work, not now pursued under weapons sponsorship, is required for commercial application. In view of the opportunity for leverage provided by the construction of the National Ignition Facility, the Office of Fusion Energy Sciences should actively develop the energy-related technologies for inertial fusion. All should strive to break down the barriers that separate the fusion community into inertial and magnetic camps."

The symposium also considered the topic, "Promising (non-tokamak magnetic) Pathways to Commercial Fusion." The summary states, "There are a large number of concepts and variations on concepts and, despite FEAC and FESAC reviews of overall alternate concept policy, no agreed upon procedure is yet in place for setting priorities among them. Such a procedure should be established. Some alternates benefit from the extensive tokamak database more than others and hence

progress on these concepts can be expedited. On the other hand, risk is reduced if some concepts explored are orthogonal to the toroidal magnetic concepts." It comments, "Although the DOE Office of Fusion Energy Sciences has announced plans to increase the level of effort on alternates, only modest increases have materialized thus far and the process for determining a new program balance is unclear. Though many concepts can apparently be explored at modest levels initially, the budgetary impact in future years of initiating a large number of concepts does not appear to have been thought through."

Finally, the symposium addressed the question, "Do fusion power plants really require Low Activation Materials?" The summary concludes, "Materials are important to the commercial success of many technologies, especially nuclear technologies. Fusion will require advanced materials that function in a unique environment. A materials development program is thus essential for fusion. "Low activation" is a desirable attribute for fusion materials, but other attributes may be more important for both technical feasibility and economics. Therefore, a comprehensive program, which takes into account system tradeoffs, is required."

The summary states, "Though obviously not all of the 65 participants would agree on everything, (the summary) attempts to express what appeared to be a broad consensus. Proceedings of the symposium will be published in a forthcoming issue of the *Journal of Fusion Energy* (Plenum Press). Copies of the summary may be obtained from Fusion Power Associates, 2 Professional Drive, Suite 249, Gaithersburg, MD 20879 (email:72570.707@compuserve.com).

NIF ESCAPES ANOTHER COURT CHALLENGE

Workers excavating the National Ignition Facility (NIF) construction site, in early September, unearthed over 100 capacitors containing hazardous (PCB) materials, resulting in a new court challenge from activist groups seeking to halt NIF construction. The capacitors apparently were buried there some time during the 1960's. Officials at Lawrence Livermore National Laboratory, the NIF site, promptly notified the appropriate government agencies and instituted procedures for removing the waste. Cleanup was completed and excavation resumed on September 12, prompting the activist groups to return to U.S. District Court seeking an injunction to halt construction. The groups charged that "DOE and Livermore Lab willfully ignored this very real threat to human health and our environment." They claimed "The events of the last several weeks provide compelling evidence to support Plaintiffs' claim that Defendants have violated NEPA by failing to take a hard look at the environmental impacts of the National Ignition Facility." Officials of the Environmental Protection Agency, however, stated that there was no public health risk associated with the unearthed capacitors.

The court once again refused to halt NIF construction, but rather ordered DOE to accommodate the group's request that additional environmental impact analyses be carried out for the site. Under the terms of the latest agreement, DOE will drill additional groundwater monitoring wells and do additional environmental reviews related to identification of potential additional historic waste disposal areas, culminating in preparation of a supplement to the Programmatic Environmental Impact Statement. A further hearing was scheduled for January 20 on the issue of DOE compliance.

NIF project officials have indicated that approximately $200 million of the $1.2 billion construction cost has either been obligated or spent thus far. During FY 1998, an additional $230 million will be committed. Thus far, project officials indicate NIF is "on cost, on schedule" for completion in 2003. The Livermore Laboratory began in October to issue a newsletter, "ICF Program Monthly Highlights." The October issue indicates that excavation of the NIF site is now 95% complete, despite the delay caused by the discovery of buried hazardous waste. Copies can be requested from Don Correll (510)422-6784 (email;correll1@llnl.gov).

DOE RENEWS ROCHESTER CONTRACT

The U.S. Department of Energy announce a $143 million, 5-year renewal of its contract with the University of Rochester Laboratory for Laser Energetics. The University has worked on inertial confinement fusion using high power lasers since 1978. Energy Secretary Federico Peña said, "Rochester has had a long and successful commitment to laser fusion research and has produced outstanding technical and academic achievements. We are pleased to continue tapping this strategically important resource for research that will benefit our national security." DOE said the research would play "a critical role in the Energy Department's stockpile stewardship program, the plan to ensure the safety and reliability of the nation's nuclear weapons stockpile without underground nuclear tests." President Clinton recently signed, and sent to the Senate for ratification, the Comprehensive Test Ban Treaty, under which the U.S. and other countries agree to refrain from underground nuclear weapons tests. But retired Livermore weapons scientist Hugh DeWitt said the idea that laser fusion research would help safeguard the nation's nuclear weapons stockpile was "a bill of goods sold to Congress." He said, "The work at Rochester stands on its own as very good physics. The work will contribute toward our understanding of fusion reactions. It is long-range, basic research and worth the money government is putting into it. It is unnecessary and uncalled for to connect it to weapons."

Victor Reis, DOE Assistant Director for Defense Programs, said the laser research plays a critical role in the department's stockpile stewardship program. Reis said the contract renewal "will enhance the effective partnership among academia, the Energy Department and its national laboratories," and called the Rochester laser lab "a full member of the team." Rochester area Congresswoman Louise Slaughter said in a statement, "I am pleased to help the University of Rochester's Laboratory for Laser Energetics get this renewed funding, and I'm glad the university has this commitment from the Department of Energy. Rochester continues to be a central location for technology and innovation, and I'm proud of the university's strong contributions." Lab director Bob McCrory said, "We are delighted to have the confidence of the Department of Energy and of the Congress for these very important research initiatives." He said the results of the research would be published and shared with other scientists and that the research would not aid other countries interested in acquiring nuclear weapons." The DOE said the experiments "closely duplicate certain conditions found only in the sun and other stars or inside a nuclear weapon as it is detonated. They also help in assessing the potential of inertial fusion as an inexhaustible commercial energy source."

PRINCETON AIDS PASTEURIZATION PROJECT

Researchers at a U.S. Department of Agriculture laboratory are seeking to perfect a new technology for pasteurizing liquid foods, such as milk and fruit juices, using radio-frequency waves instead of heat. The new technique would cause less deterioration of flavor, the researchers believe. In their search, they will be assisted by radio-frequency technology experts from the Princeton Plasma Physics Laboratory, who have perfected the technology for heating fusion plasmas. The advantage of the rf technique, researchers believe, is that the pasteurization may be carried out more uniformly and at a lower temperature than existing heating techniques. Hundreds of billions of pounds of liquids are pasteurized in the U.S. annually.

The cooperative project is being carried out under a memorandum of understanding between Secretary of Agriculture Dan Glickman and former Energy Secretary Hazel O'Leary, to use one Federal agency's technologies to benefit research at other Federal agencies. Princeton has extensive experience in the application of rf and microwave radiation, including techniques for optimizing the absorption of rf energy into a receiving medium, measuring rf parameters, instrumentation and the design and fabrication of antennas. A three person team from Princeton will work at the USDA's Eastern Regional Research Center in Philadelphia, assisting the researchers there to set up and operate the equipment.

For further information, contact Anthony DeMeo (609)243-2755 (email:ademeo@pppl.gov).

PRINCETON WEB SITE WINS AWARDS

An Internet web site that allows browsers to operate a virtual fusion experiment and analyze data from a real fusion experiment has recently won five awards, including being named one of the "Ten Cool Sites" in September by the Exploratorium Museum of Science in San Francisco. The site, maintained by the Princeton Plasma Physics Laboratory, is called IPPEX, for "Internet Plasma Physics Educational Experience." The IPPEX site was also named a "Hot Spot" by New Scientist magazine. Other awards were received from the JAVA Review Service, WWW Associates and the Yahooligans Directory.

Besides being noted by the above agencies, IPPEX has had an impact on students around the world. Recently, 10th grade students at the Bronx High School of Science used it as part of their physics class and a student in Italy enrolled in a graduate program in fusion and plasma physics after using IPPEX. Andrew Post Zwicker, Project Manager for IPPEX, said "We are excited we were able to develop a way for students to interact with real scientists, doing real experiments in a way that is meaningful and helpful to students. Our goal is to interest them in science and deepen their understanding of basic concepts." Its web address is http://ippex.pppl.gov/ippex/

IPPEX is funded by the New Jersey Networking Infrastructure in Education at the Stevens Institute of Technology through a grant from the National Science Foundation. For further information, contact Andrew Post Zwicker, (609)243-2116 (email:azwicker@pppl.gov).

CALENDAR

Dec. 15-19: 20th International Conference on Lasers, New Orleans. Contact: Society for Optical and Quantum Electronics, P.O. Box 245, McLean, VA 22101.

Jan. 5-10: Winter Conference on Plasma Spectrochemistry, Scottsdale, AZ. Contact: R. Barnes (email:winterconf@chem.umass.edu).

Jan. 6-9: 7th Joint Magnetism and Magnetic Materials—Intermag Conference, San Francisco. Contact: J. Nyenhuis (email: nyenhuis@ecn.purdue.edu).

Jan. 7-12: 12th International Conference on High-Power Particle Beams (BEAMS'98), Haifa, Israel. Contact: beams98@kenes.com

Jan. 20-23: Europhysics Topical Conference on RF Heating and Current Drive in Fusion Devices, Brussels, Belgium. Contact: j.vanoost@fz-juelich.de

Jan. 28-30: Tenth Gaseous Electronics Meeting, Sydney, Australia. Contact: tony.murphy@tip.sciro.au